

**SCHEME AND CURRICULUM BOOK**  
**BACHELOR OF TECHNOLOGY**  
**in**  
**Computer Science and Engineering**  
**(Artificial Intelligence)**

**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 Artificial Intelligence (AI) the university has introduced a Bachelor of Technology Programme in Computer Science & Engineering (Artificial Intelligence) in the Department of Computer Science & Engineering. We have designed the curriculum for B.Tech. Computer Science & Engineering (Artificial Intelligence). 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 (AI) 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 (Artificial Intelligence)**

**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 (Artificial Intelligence)

### PROGRAM EDUCATION OBJECTIVES

PEO1	
PEO2	
PEO3	
PEO4	

### PROGRAM OUTCOMES

PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	<b>Design/development of solutions:</b> 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	<b>Conduct investigations of complex problems:</b> 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	<b>Modern tool usage:</b> 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	<b>The engineer and society:</b> 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	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the Knowledge of, and need for sustainable development.

PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO9	<b>Individual and teamwork:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> 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	<b>Project management and finance:</b> 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	<b>Life-long learning:</b> 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

<b>PSO1</b>	
<b>PSO2</b>	

## **Chapter2: Scheme of B.Tech. CSE (AI) 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  
(Artificial Intelligence)  
(Engineering and Technology)**

# Gurugram University, Gurugram

## GENERAL COURSE STRUCTURE AND CREDIT DISTRIBUTION

### STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Category	Breakup of Credits (Total 166.5)
1	Humanities and Social Sciences, including Management courses	11
2	Basic Science courses	22
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	31.5
4	Professional core courses	64
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	14
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	26	20	900
2	II	26	21.5	900
3	III	26	22	1000
4	IV	27	21	900
5	V	31	25	1100
6	VI	26	22	900
7	VII	27	21	900
8	VIII	22	14	500
	Total	211	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

## UNDERGRADUATE ENGINEERING PROGRAM

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)**  
**Scheme of Studies/Examination w.e.f. 2022-23**

### Semester – I

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Session al	Marks for End Term Examination	Total
				L	T	P				
1	HSMC		Communication Skills in English	2	0	0	2	30	70	100
3	BSC		Mathematics-I	3	1	0	4	30	70	100
4	ESC		Basic of Electrical and Electronics Engineering OR Physics	3	0	0	3	30	70	100
				OR 3	OR 1	OR 0	OR 4	OR 30	OR 70	OR 100
5	ESC		Programming for problem solving using C	3	0	0	3	30	70	100
6	HSMC		Basics of Environmental Science	2	0	0	2	30	70	100
7	HSMC		Communication Skills in English (P).	0	0	2	1	50	50	100
8	ESC		Basic of Electrical and Electronics Engineering (P) OR Physics (P)	0	0	2	1	50	50	100
				OR 0	OR 0	OR 2	OR 1	OR 50	OR 50	OR 100
9	ESC		Programming for problem solving using C (P)	0	0	2	1	50	50	100
10	ESC		Workshop Practices (P) OR Engineering Graphics (Web Designing)	1	0		2.5	50	50	100
				OR 1	OR 0	3 OR 2	OR 2	OR 50	OR 50	OR 100
11	AU		Sports (Audit Course) Compulsory	0	0	2	0	0	0	0
<b>Total</b>				<b>14</b>	<b>2</b>	<b>10</b>	<b>20</b>			<b>900</b>

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)**  
**Scheme of Studies/Examination w.e.f. 2022-23**

## Semester – II

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	BSC		Mathematics-II	3	1	0	4	30	70	100
3	HSMC		Human Value & Soft Skills	2	0	2	3	30	70	100
4	ESC		Basic of Electrical and Electronics Engineering	3	0	0	3	30	70	100
			OR Physics	OR	OR	OR	OR	OR	OR	OR
				3	1	0	4	30	70	100
5	PCC		Data Structure Using C	3	0	0	3	30	70	100
6	PCC		Object Oriented Concepts and Python Programming	3	0	0	3	30	70	100
7	ESC		Basic of Electrical and Electronics Engineering	0	0	2	1	50	50	100
			(P) OR	OR	OR	OR	OR	OR	OR	OR
			Physics (P)	0	0	2	1	50	50	100
8	LC		Data Structure Using C (P)	0	0	2	1	50	50	100
9	LC		Object Oriented Concepts and Python Programming (P)	0	0	2	1	50	50	100
10	ESC		Workshop Practices (P)	1	0	3	2.5	50	50	100
			OR	OR	OR	OR	OR	OR	OR	OR
			Engineering Graphics (Web Designing)	1	0	2	2	50	50	100
<b>Total</b>				<b>15</b>	<b>1</b>	<b>10</b>	<b>21.5</b>			<b>900</b>

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)**  
**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		Discrete Mathematics	3	0	0	3	3	30	70	-	100	3
2.	BSC		Aptitude Reasoning- I	3	0	0	3	3	30	70	-	100	3
3.	ESC		Digital Electronics	3	0	0	3	3	30	70	-	100	3
4.	PCC		R Programming	3	0	0	3	3	30	70	-	100	3
5.	PCC		Operating System	3	0	0	3	3	30	70	-	100	3
6.	PCC		Database Management System	3	0	0	3	3	30	70	-	100	2
7.	LC		Digital Electronics Lab	0	0	2	2	1	50	-	50	100	2
8.	LC		R Programming Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Operating System Lab	0	0	2	2	1	50	-	50	100	2
10.	PCC		Database Management System Lab	0	0	2	2	1	50	-	50	100	2
			Total	18	0	8	26	22	310	490	200	1000	

**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. (Computer Science and Engineering- Artificial Intelligence)**  
**Scheme of Studies/Examination w.e.f. 2023-24**

## Semester - IV

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-II	3	0	0	3	3	30	70	-	100	3
2.	PCC		Foundation of Machine Learning	3	0	0	3	3	30	70	-	100	3
3.	PCC		Computer Architecture and Organization	3	0	0	3	3	30	70	-	100	3
4.	PCC		Analysis and Design of Algorithms	3	0	0	3	3	30	70	-	100	3
5.	PCC		Predictive Analytics	3	0	0	3	3	30	70	-	100	
6.	PCC		Applied AI and Expert System	3	0	0	3	3	30	70	-	100	3
7.	LC		Foundation of Machine Learning Lab	0	0	2	2	1	50	-	50	100	2
8.	LC		Applied AI and Expert System Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Analysis and Design of Algorithms Lab	0	0	2	2	1	50	-	50	100	2
10.	AU		*Indian Constitution	3	0	0	3	0	30	70	-	-	2
			<b>Total</b>	<b>21</b>	<b>0</b>	<b>6</b>	<b>27</b>	<b>21</b>	<b>360</b>	<b>490</b>	<b>150</b>	<b>900</b>	

**\*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. (Computer Science and Engineering- Artificial Intelligence)  
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		Computer Networks	3	0	0	3	3	30	70	-	100	3
2.	PCC		Theory of Computation	3	0	0	3	3	30	70	-	100	3
3.	PCC		Natural Language Processing	3	0	0	3	3	30	70	-	100	3
4.	PCC		Data Mining and Warehousing	3	0	0	3	3	30	70	-	100	3
5.	PCC		Text & Web Intelligence	3	0	0	3	3	30	70	-	100	3
6.	PEC		*Professional Elective Course-I	3	0	0	3	3	30	70	-	100	3
7.	OEC		*Open Elective Course-I	3	0	0	3	3	30	70	-	100	3
8.	LC		Computer Networks Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Text and Web Intelligence Lab	0	0	2	2	1	50	-	50	100	2
10.	LC		Data Mining and Warehousing Lab		0	2	2	1	50	-	50	100	3
11.	TRAI NING		Practical Training-I			4	4	1	50	-	50	100	3
<b>Total</b>				<b>21</b>	<b>0</b>	<b>10</b>	<b>31</b>	<b>25</b>	<b>410</b>	<b>490</b>	<b>200</b>	<b>1100</b>	

**\*NOTE:**

1. Choose any one from Professional Elective Course – I
2. Choose any one from Open Elective Course – I

**Professional Elective Course – I**

1. wireless & mobile networks
2. Mobile application development for AI
3. Introduction to Cloud Computing
4. Distributed Databases

## Semester - VI

S.N.	Category	Course	Course Title	Hours Per	Total	Credits	Examination Schedule (Marks)	Duration
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		Code		week			Contact Hrs. per week						of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Soft Computing	3	0	0	3	3	30	70		100	3
2.	PCC		Big Data Analysis	3	0	0	3	3	30	70		100	3
3.	PCC		Data Science using AI approach	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		Data Science using AI approach Lab	0	0	2	2	1	50		50	100	2
8.	LC		Soft Computing Lab	0	0	2	2	1	50		50	50	2
9.	LC		Big Data Analysis Lab	0	0	2	2	1	50		50	50	2
10.	PROJ		Project - I	0	0	2	2	1	50		50	100	3
			<b>Total</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>26</b>	<b>22</b>	<b>380</b>	<b>420</b>	<b>200</b>	<b>900</b>	

**NOTE:**

1. 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 etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.
2. Choose any one from Professional Elective Course – II
3. Choose any one from Professional Elective Course – III
4. Choose any one from Open Elective Course – II

**Professional Elective Course – II**

1. Computer Graphics
2. Cryptography and Security
3. Pattern and Visual Recognition
4. Internet of Things
5. Advance Database Management System

**Professional Elective Course – III**

1. Advanced Java
2. Compiler Design
3. Speech Processing and Applications
4. Software Engineering

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

**Semester - VII**

S.N	Category	C	Course Title	Hours Per week	Total	Credits	Examination Schedule (Marks)	Duration of
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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.	PROJE CT		Project – III / Industrial Project	0	0	16	16	8	150		150	300	3
			Total	6	0	16	22	14	150	-	150	500	

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

### **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	2	3	II

4.		Organizational Behavior	3	0	0	3	VII
Total Credits						11	

### 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.		Mathematics-II	3	1	0	4	II
3.		Physics	3	1	2	5	II
4.		Aptitude Reasoning-I	3	0	0	3	III
5.		Discrete Mathematics	3	0	0	3	III
6.		Aptitude Reasoning-II	3	0	0	3	IV
Total Credits						22	

### 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	I
2.		Programming for problem-solving using C	3	0	2	4	I
3.		Workshop Practices(P)	1	0	3	2.5	I
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	II
7.		Digital Electronics	3	0	2	4	III
9.		MOOC - I (Essential)	3	-	-	3	VIII
10.		MOOC - II (Essential)	3	-	-	3	VIII
Total Credits						31.5	

### PROFESSIONAL CORE COURSES (PCC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Database Management Systems	3	0	2	4	III
2.		Operating System	3	0	2	4	III
3.		R programming	3	0	2	4	III
4.		Analysis and design of algorithm	3	0	2	4	IV
5.		Computer Architecture and Organization	3	0	0	3	IV
6.		Applied AI and Expert System	3	0	2	4	IV
7.		Predictive Analytics	3	0	0	3	IV
8.		Foundation of Machine Learning	3	0	2	4	IV
9.		Text and Web intelligence	3	0	2	4	V
10.		Theory of Computation	3	0	0	3	V
11.		Computer Networks	3	0	2	4	V
12.		Natural language Processing	3	0	0	3	V
13.		Data Mining and Warehousing	3	0	2	4	V
14.		Data Science Using AI approach	3	0	2	4	VI
15.		Big Data Analytics	3	0	2	4	VI
16.		Soft Computing	3	0	2	4	VI
17.		Cognitive Computing	3	0	2	4	VII
<b>Total Credits</b>						64	

### 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	-	-	-	-	V
2.		Project – I	0	0	4	2	VI
3.		Practical Training – II	0	0	1	-	VII
4.		Project – II	0	0	8	4	VII
5.		Project – III	0	0	16	8	VIII
Total Credits						14	

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

# Semester I

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	HSMC		Communication Skills in English	2	0	0	2	30	70	100
3	BSC		Mathematics-I	3	1	0	4	30	70	100
4	ESC		Basic of Electrical and Electronics Engineering OR Physics	3 OR 3	0 OR 1	0 OR 0	3 OR 4	30 OR 30	70 OR 70	100 OR 100
5	ESC		Programming for problem solving using C	3	0	0	3	30	70	100
6	HSMC		Basics of Environmental Science	2	0	0	2	30	70	100
7	HSMC		Communication Skills in English (P).	0	0	2	1	50	50	100
8	ESC		Basic of Electrical and Electronics Engineering (P) OR Physics (P)	0 OR 0	0 OR 0	2 OR 2	1 OR 1	50 OR 50	50 OR 50	100 OR 100
9	ESC		Programming for problem solving using C (P)	0	0	2	1	50	50	100
10	ESC		Workshop Practices (P) OR Engineering Graphics (Web Designing)	1 OR 1	0 OR 0	3 OR 2	2.5 OR 2	50 OR 50	50 OR 50	100 OR 100
11	AU		*Sports (Audit Course) Compulsory	0	0	2	0	0	0	0
<b>Total</b>				<b>14</b>	<b>2</b>	<b>10</b>	<b>20</b>			<b>900</b>

**\*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.

Course code	HSE-101				
Category	Humanities and Social Sciences				
Course title	Communication Skills in English				
Scheme and Credits	L	T	P	Credits	
	2	0	0	2	
Class work/ Practical	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### **COURSE OUTCOMES:**

1. The course will focus on the four integral skills of language, improving the proficiency levels in all of them and to learn to use language as a tool for effective communication.
2. The course will focus on the four integral skills of language, improving the proficiency levels in all of them and to learn to use language as a tool for effective communication
3. This course will widen the understanding of the learners in all genres of literature (short stories, poetry, autobiographies.) with the help of expository pieces .
4. The course will strive to equip the learner with the ability to express oneself and be understood by others with clarity and precision, in both written and spoken forms.
5. This course will encourage creative use of language through translation, paraphrasing and paragraph writing.
6. Along with the above, the course will also build confidence and encourage the students to use a standard spoken form of English in order to prepare them to face job interviews, workplace and in higher studies.

### **UNIT-I**

Remedial English : Parts of speech, Gerunds, Participles and infinitives; Clauses; Sentence constructions (unity; avoidance of choppy and rambling sentences, logic and consistency, conciseness, sequencing of ideas); Sentence errors-agreement between verb and subject, pronoun and antecedents, sequence of tenses, problems involving modifiers (dangling and misplaced modifiers); Shifts in point of view consistency of number and person, tense, mood, voice and subject; Parallelism; Omissions and mixed constructions.

### **UNIT-II**

Vocabulary : Methods of building vocabulary-etymological roots, prefixes and suffixes; Commonly used foreign words and phrases; spelling; words often confused synonyms and homonyms; one word substitutes; verbal idioms.

### **UNIT-III**

Punctuation and Mechanics: End Punctuation; internal Punctuation; Word Punctuation. Comprehension: Abstracting; Summarizing; Observation, Findings and Conclusions; Illustration and Inductive Logic; Deduction and Analogy.

## UNIT-IV

Presentation: Oral presentation- Extempore, discussion on topics of contemporary relevance, Interviews.

Course Code	BSM-101				
Category	Basic Science Course				
Course title	Mathematics-I				
Scheme and Credits	L	T	P	Credits	
	3	1	0	4	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Written Comprehension: The ability to write after listening to and reading select speeches, news bulletins, presentations and answering questions based on what has been heard. Reading the given texts to skim, scan, infer and answer comprehension questions. Reading texts like case studies and project reports for critical assessment and book Review.

### Suggested Books:

1. Nitin Bhatnagar and Mamta Bhatnagar, Communicative English for Engineers and Professionals. Pearson Education.
2. Bhatnagar, k. Manmohan. Ed. The Spectrum of Life: An Anthology of Modern Prose. Delhi: Macmillan India Ltd., 2006.
- 3 C. Murlikrishna & Sunita Mishra, Communication Skills for Engineers, Pearson Ed.
- 4 Sinha, R.P. Current English Grammar and Usage. OUP.
5. Rizvi, M. Ashraf. Effective Technical Communication. McGraw Hill Education (India) Pvt. Ltd., 2014.
6. Eastwood, John. Oxford Guide to English Grammar. OUP, 2010.
7. Kumar, Sanjay and PushpLata. Communication Skills. OUP, 2011.
8. Raman, Meenakshi and Sangeeta Sharma. Communication Skills. New Delhi: OUP, 2011.
9. Hill, L.A. A Guide to Correct English. London: OUP, 1965.
10. Oxford Dictionary of English Idioms. New Delhi: OUP, 2009
- 11 \*<http://yousigma.com/religionandphilosophy/swamivivekananda/thesecretofwork.pdf>

## COURSE OBJECTIVES

Course code	BSP-101				
Category	Basic Science Course				
Course title	Physics				
Scheme and Credits	L	T	P	Credits	
	3	1	0	4	
Class work	30Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

1. To develop logical understanding of the subject
2. To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
3. To make aware students about the importance and symbiosis between Mathematics and Engineering.

### UNIT-I

Matrices: Matrices, Vectors: addition and scalar multiplication, Matrix multiplication, Linear systems of equations, Linear Independence, Rank of a matrix, Determinants, Cramer's Rule, Inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

### UNIT-II

Vector spaces I: Vector Space, Linear dependence of vectors, Basis, Dimension, Range and kernel, Rank and nullity, Inverse of a linear transformation, Rank nullity theorem,

### UNIT-III

Vector spaces II: Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric and Orthogonal Matrices, Eigen bases, Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.

### UNIT-IV

Calculus: Indeterminate forms and L' Hospital's rule, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems, Evaluation of definite and improper integrals, Applications of definite integrals to evaluate surface areas and volumes of revolutions, Beta and Gamma functions and their properties.

### Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. D. Poole, Linear Algebra: A Modern Introduction, Brooks Cole.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

### UNIT – I

Review of Atomic Structure and Statistical Mechanics: - Ideas on Atomic Structure, Quantum Mechanics, The Schrodinger Wave Equation, Statistical Mechanics, Bonding of atoms, Crystalline state

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

## UNIT - II

Elemental and compound semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, The Hall Effect, Einstein Relations, Excess carriers in semiconductors p-n junction, Excess carriers and Quasi-Fermi Levels, Basic equations for semiconductor device operation, Solution of carrier transport equation.

## UNIT - III

P-N Junctions: - The abrupt junction (Electric field, potential, capacitance), V-I characteristic of an ideal diode, a real diode. Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

## UNIT - IV

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission. Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band- diagram.

### Suggested reference books

1. Pierret, Semiconductor Device Fundamental,
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Pearson Education
3. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
4. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
5. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley
6. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York.
7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
8. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

Course code	EEE-101				
Category	Engineering Science Course				
Course title	Basics of Electrical and Electronics Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

## **COURSE OBJECTIVES**

1. To provide basic knowledge of different elements of electrical and electronics engineering field.
2. To familiarize the students with the concepts of electrical circuits and network Analysis.
3. To understand the basics of AC and DC circuits.
4. To familiarize students to the analysis and design of analog electronic circuits which form the basic building blocks of almost any electronic system.
5. To introduce p-n junction theory, operation of the semiconductor devices and their use in basic electronic circuits.

## **UNIT-I**

**DC Circuits:** Role and importance of circuits in Engineering, Concept of fields, charge, current, voltage, energy and their interrelationships. Electrical circuit elements (R, L and C), voltage and current sources (ideal & Controlled) series and parallel circuits, Network reduction: voltage and current division Kirchhoff current and voltage laws with their applications (Nodal and Mesh Analysis), Source transformation - star delta conversion. Superposition theorem, Thevenin and Norton Theorems, Millman, Substitution and Reciprocity theorem.

### UNIT-II

**AC Circuits:** Representation of sinusoidal waveforms, average, peak and rms values, complex representation of impedance, phasor representation, complex power, real power, reactive power, apparent power, power factor and Energy, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Resonance; Introduction to three-phase circuits

### UNIT-III

Introduction to p-n junction diode and its applications. Half wave & full wave rectifiers. Clipping and clamping circuits, Varactor, Varistor, Voltage Regulator  
Bipolar junction transistors and its biasing BJT operation, BJT voltages and currents, CE, CB and CC characteristics, DC load line and bias point, base bias, emitter feedback bias, collector feedback bias, voltage divider bias, Thermal stability, biasing BJT switching circuits, transistor power dissipation and switching time, Testing of bipolar junction transistor with multi-meter, Reading datasheet of BJT.

### UNIT-IV

Field Effect Devices: JFET : basic Operation and characteristics, drain and transfer characteristics, pinch off voltage, parameters of JFET: Transconductance ( $g_m$ ), ac drain resistance ( $r_d$ ), amplification factor ( $\mu$ ), Small Signal Model & Frequency Limitations. MOSFET: basic operation, depletion and enhancement type, pinch-off voltage, Shockley equation and Small Signal Model of MOSFET, MOS capacitor.

#### Suggested books:

1. E. Huges, "Electrical Technology", ELBS.
2. J. Millman and C. Halkias, Integrated Electronics, McGraw Hill, 2<sup>nd</sup> Edition, 2009.
3. M.M. Mano: Digital Logic Design, Phi.

#### Suggested reference books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. Del Toro, "Principles of Electrical engineering", PHI.
3. A. Sedra and C. Smith, Microelectronic Circuits: Theory and Applications, Oxford University Press, 6<sup>th</sup> Edition, 2013.
4. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory" Pearson publishers, 10<sup>th</sup> Edition
5. R.P. Jain: Modern Digital Electronics, Tmh.
6. Malvino and Leach, "Digital Principles and Applications", TMH publishers, 8<sup>th</sup> Edition
7. Tyagi M.S., "Introduction to Semiconductor Materials and Devices", John Wiley & Sons, 1993.
8. Basic Electrical Engineering, A.E. Fitzgerald, David Higginbotham 2009, Arvin Grabel, Tata McGraw-Hill Publishing Company; 5<sup>th</sup> Edition.

Course code	CSE-101				
Category	Professional Core Course				
Course title	Programming for Problem Solving Using C				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

#### **UNIT-I**

Introduction to Programming: Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. C Programming: Keywords, Variables and Data Types: basic, derived and user defined, Type Conversions, Header Files, Basic Input and Output Functions and Statements, Compilation, Syntax and Logical Errors in compilation, Object and Executable Code, Storage Classes, Arithmetic Expressions and Precedence.

#### **UNIT-II**

Preprocessors, Conditional and Branching Statements, Loops/ Iterative Statements, Writing and evaluation of conditionals and consequent branching.

#### **UNIT-III**

Arrays (1-D, 2-D), Character Arrays and Strings, Arrays with Pointers, Functions (including using built in libraries), Parameter passing in functions, Call by Value, Call by Reference, Passing arrays to functions, Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

#### **UNIT-IV**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, Introduction to Dynamic Memory Allocation and its Methods, Structures, Union, Defining Structures and Array of Structures, File Handling.

#### **Suggested Text Books:**

1. Ajay Mittal, Programming in C, 'A Practical Approach', Pearson Education.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Yashavant Kanetkar, Let Us C, BPB Publication.
5. Gill, Nasib Singh: Computing Fundamentals and Programming in C, Khanna Book Publishing Company(Private) Limited, New Delhi

#### **Suggested Reference Books**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course code	ENV-101				
Category	Humanities and Social Sciences				
Course title	Basics of Environmental Science				
Scheme and Credits	L	T	P	Credits	
	2	0	0	2	
Class work/Practical	50Marks				
Exam	50Marks				
Total	100Marks				
Duration of Exam	03 Hours				

### **COURSE OBJECTIVES:**

1. To impart the knowledge and awareness for the environmental protection for real-time contribution during an execution of engineering practices in the society.

### **COURSE OUTCOMES:**

1. To understand the basic concepts of environmental studies and natural resources.
2. To learn about the various eco-systems of nature.
3. To gain knowledge about different types of environmental pollutions and their control
4. measures.
6. To acquire the knowledge about the various social aspects related to the environment.

### **UNIT-I**

**Environmental studies and Natural Resources:** Definition, scope and importance of environmental studies.

**Natural Resources:** Renewable and non-renewable resources, and associated problems

(a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

(d) Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers-pesticides problems, water logging, salinity.

(e) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

### **UNIT-II**

**Eco Systems:** Concept of an eco-system, Structure and function of an eco-system, Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems:

- (a) Forest ecosystem

- (b) Grass land ecosystem
- (c) Desert ecosystem
- (d) Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)

### UNIT-III

**Environmental Pollution:** Definition, Causes, effects and control measures of;

- (a) Air pollution
- (b) Soil pollution
- (c) Marine pollution
- (d) Noise pollution
- (e) Nuclear hazards

**Disaster management:** Floods, earth quake, cyclone and landslides.

### UNIT-IV

**Social issues and the Environment:** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.

**Environmental ethics:** issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment protection Act, Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife protection Act, Forest conservation Act, Issues involved in enforcement of environmental legislations.

#### **Recommended Books:**

1. Textbook of Environmental studies, Erach Bharucha, UGC.
2. Fundamental concepts in Environmental Studies, D. D. Mishra, S Chand & Co Ltd.

Course code	HSE-101P				
Category	Humanities and Social Sciences				
Course title	Communication Skills in English (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work/ Practical	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

**Lab Activity:** The students will acquire basic proficiency in English with special emphasis on listening, comprehension and speaking skills both at social and professional platforms.

- (i) Listening comprehension
- (ii) Recognition of phonemes in International Phonetic Alphabet
- (iii) Self introduction and introduction of another person
- (iv) Conversation and dialogues in common everyday situations
- (v) Communication at work place (Standard phrases and sentences in various situations)
- (vi) Telephonic communication
- (vii) Speeches for special occasions (Welcome speeches, Introduction speeches, Felicitation speeches and Farewell speeches)
- (viii) Tag Questions
- (ix) Formal Presentations on literary texts prescribed in theory paper, Question Formation & Mock Press Conference

Course code	BSP-101P				
Category	<b>Basic Science Course</b>				
Course title	<b>Physics (P)</b>				
Scheme and Credits	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	
	<b>0</b>	<b>0</b>		<b>1</b>	
Class work	<b>50 Marks</b>				
Exam	<b>50 Marks</b>				
Total	<b>100 Marks</b>				
Duration of Exam	<b>03 Hours</b>				

To

1. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
2. To determine Planks constant using photocell.
3. To measure e/m of electron using helical method.
4. To find capacitance of condenser using fleshing and quenching experiment.
5. To find temperature co-efficient of platinum using Callender Griffith bridge.
6. To find out low resistance by Carry Foster bridge.
7. To find resistance of galvanometer by post office box.
8. To measure resistance using four probe methode.
9. To compare the capacitance of two capacitors using De'Sauty Bridge.
10. To study the characteristics of Solar cell and find out the fill factor..

Course code	EEE-101P				
Category	Engineering Science Course				
Course title	<b>Basics of Electrical and Electronics Engineering (P)</b>				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50 Marks				
Exam	<b>50 Marks</b>				
Total	<b>100 Marks</b>				
Duration of Exam	03 Hours				

Note: At least 8 experiments are to be performed by the students.

**List of Subject related Experiments:**

1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross-sectional area of the conductor.
2. Verification of Ohm's Law, Kirchhoff current and voltage laws
3. Verification of temperature co-efficient of resistance: (i) Positive for Tungsten and Nichrome and (ii) Negative for carbon.
4. To measure DC voltage and current, AC voltage and current with multi-meter
5. To observe waveforms on oscilloscope, measure basic parameters amplitude and frequency of sine wave and square wave.
6. Obtain VI characteristics of semiconductor rectifier diode, LED, Photo-diode
7. To observe waveform at the output of half wave rectifier with and without filter capacitor.
8. To observe waveform at the output of full wave rectifier with and without filter capacitor.
9. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
10. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
11. To study the transfer and drain characteristics of JFET and calculate its various parameters.
12. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.

**Note:** At least 6 experiments are to be performed by the students.

### List of Subject related Experiments:

### LABORATORY OUTCOMES

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

#### Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

#### Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

#### Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

#### Tutorial 4: Loops, while and for loops:

Course code	CSE-101P			
Category	Professional Core Course			
Course title	Programming for Problem Solving Using C (P)			
Scheme and Credits	L	T	P	Credits
	0	0	2	1
Class work	50 Marks			
Exam	50 Marks			
Total	100 Marks			
Duration of Exam	03 Hours			

Lab 4: Iterative problems e.g., sum of series

#### Tutorial 5: 1D Arrays

Lab 5: 1D Array manipulation

#### Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

#### Tutorial 7: Functions, call by value:

Lab 7: Simple functions

## SYLLABUS

Brief history of Internet, introduction to world wide web, basic principles involved in developing a web site, rules of web designing, web standards, audience requirements, Design concept.

Introduction to elements of HTML, XHTML and CSS.

Javascript as programming language, Language Syntax: Data types, Values, Variables, Expressions and Operators. JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure.

Introduction of Google Web Designer, Firefox, Wordpress, sublime text, Angular.JS, jQuery etc.

**Note:** At least 8 experiments are to be performed by the students.

### Lab work

Course code	CSE-103P				
Category	Engineering Science Course				
Coursetitle	Engineering Graphics (Web Designing)				
Scheme and Credits	L	T	P	Credits	
	1	0	2	2	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### List of Subject related Experiments:

1. Prepare a survey document of ten website which you like and dislike with various reasons.  
(Prerequisite )
2. Introduction to basic HTML elements
3. Use table tag to format web page. Also create the Time Table of your class using table tag.
4. Create your profile page i.e. educational details, Hobbies, Achievement, My Ideals etc.
5. Create Style sheet to set formatting for text tags and embed that style sheet on web pages created

for your site. Design a web page and embed various multimedia features in the page.

6. Design signup form to validate username, password, and phone numbers etc using Java script.
7. Write a JavaScript program to determine whether a given year is a leap year in the Gregorian calendar.

Course code	MEE-102P				
Category	Engineering Science Course				
Course title	Workshop Practices (P)				
Scheme and Credits	L	T	P	Credits	
	1	0	3	2.5	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

8. Write a JavaScript program to convert temperatures to and from celsius, Fahrenheit.
9. Installation of Wordpress and designing the wordpress site.
10. Introduction to Dreamweaver and setting up site using Dreamweaver.
11. Submission of Website with Report.

## **COURSE OBJECTIVES**

1. To impart fundamental Knowledge of engineering practices such as fitting, wood working, foundry, machining, welding, etc. for manufacturing a product.

2. To prepare the students to understand the various tools and equipment's used in these processes and their working principle
3. To impart fundamental Knowledge of Lathe machine
4. To able to understand the basic knowledge of various welding processes

## **SYLLABUS**

### **Introduction:**

Introduction to Manufacturing Processes and their Classification, Introduction to additive manufacturing, Industrial Safety.

### **Machining Shop:**

Lathe, description of lathe: headstock, tailstock, gearbox, carriage, apron, cutting speed, feed & depth of cut, cutting tools, Chucks: 3 jaw, 4 jaw.

### **Fitting shop:**

Introduction, classification of metals: ferrous and nonferrous, fitting tools: measuring and marking tools, marking schemes for a fitting jobs, cutting tools.

### **Carpentry shop:**

Introduction of carpentry, types of woods, carpentry tolls: measuring tools, marking tolls, cutting tools: saws, chisels, planning tools, drilling tools, striking tools, wood working joints, wood working lathe.

### **Foundry Shop:**

Introduction, foundry hand tools, measuring boxes, ladle, moulding, furnaces, Types of Pattern and Allowances

### **Welding Shop:**

Introduction to welding, Classification of Welding Processes, Arc welding & Gas welding equipment's.

### **Reference Books:**

1. S K Hajra Choudhury, Nirjhar Roy, A K Hajra Choudhury, Elements of workshop Technology (vol. 1&2), Media Promoters.
2. B S Raghuwanshi, A Course in Workshop Technology (manufacturing Process vol. 1& 2) Dhanpat Rai & CO.
3. O.P. Khanna, Workshop Technology. Dhanpat Rai Publication.
4. W A J Chapman, Workshop technology in SI unit (part – 1 &2), Mc Graw Hill Education.
5. M.P. GROOVER, Principles of Modern Manufacturing, Wiley.
6. Kalpakjian, Manufacturing Process for Engineering Materials, Pearson Education India.

### **Lab Work**

### List of Experiments

1. To study different types of measuring tools used in metrology and determine least counts of vernier callipers, micrometres and vernier height gauges.
  2. To study different types of machine tools (lathe, shaper, planer, milling, drilling machines)
  3. To prepare a job on a lathe involving like facing, outside turning, taper turning, step turning, radius making and parting-off.
  4. To study different types of fitting tools and marking tools used in fitting practice.
  5. To prepare a job made out of MS Flats, making saw – cut filling V-cut taper at the corners.
  6. To prepare lay out on a metal sheet by making and prepare rectangular tray pipe shaped components e.g. funnel.
  7. To prepare joints for welding suitable for butt welding and lap welding.
  8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
  9. To prepare simple engineering components/shapes by forging.
  10. To prepare mold and core assembly.
  11. To prepare horizontal surface/vertical surface/curved surface/slats or V-grooves on a shaper/planner.
  12. To prepare a job involving side and face milling on a milling
  13. To prepare a job on CNC Machine/Additive Manufacturing.
- Note :** At least eight experiments/jobs are to be performed/prepared by the students in the semester.

## B. Tech. (Computer Science and Engineering- Artificial Intelligence) Scheme of Studies/Examination w.e.f. 2023-24 Semester - II

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	BSC		Mathematics-II	3	1	0	4	30	70	100
3	HSMC		Human Value & Soft Skills	2	0	2	3	30	70	100
4	ESC		Basic of Electrical and Electronics Engineering OR Physics	3	0	0	3	30	70	100
				OR 3	OR 1	OR 0	OR 4	OR 30	OR 70	OR 100
5	PCC		Data Structure Using C	3	0	0	3	30	70	100
6	PCC		Object Oriented Concepts and Python Programming	3	0	0	3	30	70	100
7	ESC		Basic of Electrical and Electronics Engineering (P) OR	0	0	2	1	50	50	100
				OR 0	OR 0	OR 2	OR 1	OR 50	OR 50	OR 100

Course Code	BSM-102				
Category	Basic Science Course				
Course title	Mathematics-II				
Scheme and Credits	L	T	P	Credits	
	3	1	0	4	
Class work	30Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

			Physics (P)							
8	LC		Data Structure Using C (P)	0	0	2	1	50	50	100
9	LC		Object Oriented Concepts and Python Programming (P)	0	0	2	1	50	50	100
10	ESC		Workshop Practices (P)	1	0	3	2.5	50	50	100
			OR Engineering Graphics (Web Designing)	OR 1	OR 0	OR 2	OR 2	OR 50	OR 50	OR 100
<b>Total</b>				<b>15</b>	<b>1</b>	<b>10</b>	<b>21.5</b>			<b>900</b>

**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

## **COURSE OBJECTIVE**

1. Demonstrate their understanding of mathematical ideas from multiple perspectives.
2. To develop logical understanding of the subject
3. To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
4. To make aware students about the importance and symbiosis between Mathematics and Engineering.

### **UNIT-I**

**Random variables and discrete probability distributions:** Conditional probability, Probability spaces, Discrete random variables, Independent random variables, Expectation of discrete random variables, Sums of independent random variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality, The multinomial distribution, Poisson approximation to the binomial distribution, Infinite sequences of Bernoulli trials.

### **UNIT-II**

**Continuous and Bivariate probability distribution:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities, Bivariate distributions and their properties, Distribution of sums and quotients, Conditional densities, Bayes' rule.

### **UNIT-III**

**Basic Statistics: Measures of Central tendency:** Moments, Skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions; Correlation and regression – Rank correlation; Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas and more general curves.

### **UNIT-IV**

**Applied Statistics:** Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations; Small samples: Test for single mean, difference of means and correlation coefficients; Test for ratio of variances – Chi-square test for goodness of fit and independence of attributes

## **Reference Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
3. S. Ross, A First Course in Probability, Pearson Education.
4. W. Feller, An Introduction to Probability Theory and its Applications, Wiley.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill Publishing Company Limited.

## COURSE OBJECTIVES

1. The course aims at developing the desired English language skills of students of Engineering and Technology so that they become proficient in communication to excel in their professional lives. The course has been designed as to enhance their linguistic and communicative competence.
2. Understanding (Clarity) of Human Relationships and Family.
3. Exposure to Issues in Society and nature (larger manmade systems and Nature).

### UNIT-I

Motivation and Objectives of Human Values Course, Purpose of Education, Complimentarily of skills and values, how the current education system falls short, Peers Pressure, Social Pressure In various dimensions of life, Concept of Competition and Time Management.

Course code	HSV-102				
Category	Humanities and Social Sciences				
Course title	Human Values and Soft Skills				
Scheme and Credits	L	T	P	Credits	
	2	0	2	3	
Class work/Practical	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### UNIT-II

Concept of Preconditioning, Concept of Natural Acceptance in Human Being, Understanding Relationships, Dealing with anger, Nine universal values in human relationships. Concept of prosperity, idea of Society, Idea of decentralization of politics, economics, education, justice etc., Its comparison with centralized systems, Balance in nature.

### UNIT-III

Techniques of Good Writing, Writing self-assessment tasks, Precis writing and note making. Paragraph and Essay writing, Article writing and summarizing

### UNIT-IV

Business Communication: Formal and Informal Letter writing, Statement of Purpose, Job application & CV (summary statement of academic & professional profiles) and Power point presentations through relevant slides.

**English Lab Activity:** Blog Writing/Creating a Newsletter, Script writing & enacting for a street play. Develop negotiating skills by using appropriate language of courtesy, Recording individual efforts and holding paired interactions and Group Discussions, Preparing and practicing for Interviews.

### Suggested reference books

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson Education, 2013.
2. Swan, Michael. Practical English Usage. OUP, 1995.
3. Gangal, J.K. Practical Course in Spoken English. New Delhi: PHI Learning, 2015.
4. Konar, Nira. Communication Skills for Professionals. New Delhi: PHI Learning Pvt.

- Ltd., 2009.
5. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Longman, 1983.
  6. Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists. Delhi: PHI Learning Pvt. Ltd., 20.
  7. Annie Leonard, `` The Story of Stuff,`` Free Press.
  8. Mohandas Karamchand Gandhi,`` The Story of My Experiments with Truth,`` Beacon Press
  9. J Krishnamurthy,`` On Education,`` Official repository
  10. Hermann Hesse ,`` Siddhartha,`` Bantam Books.
  11. On Education - The Mother Aurobindo Ashram Publication

Course code	EEE-101				
Category	Engineering Science Course				
Course title	Basics of Electrical and Electronics Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

## COURSE OBJECTIVES

1. To provide basic knowledge of different elements of electrical and electronics engineering field.
2. To familiarize the students with the concepts of electrical circuits and network Analysis.
3. To understand the basics of AC and DC circuits.
4. To familiarize students to the analysis and design of analog electronic circuits which form the basic building blocks of almost any electronic system.
5. To introduce p-n junction theory, operation of the semiconductor devices and their use in basic electronic circuits.

### UNIT-I

**DC Circuits:** Role and importance of circuits in Engineering, Concept of fields, charge, current, voltage, energy and their interrelationships. Electrical circuit elements (R, L and C), voltage and current sources(ideal & Controlled),series and parallel circuits, Network reduction: voltage and current division Kirchoff current and voltage laws with their applications (Nodal and Mesh Analysis), Source transformation - star delta conversion. Superposition theorem, Thevenin and Norton Theorems, Millman, Substitution and Reciprocity theorem.

### UNIT-II

**AC Circuits:** Representation of sinusoidal waveforms, average, peak and rms values, complex representation of impedance, phasor representation, complex power, real power, reactive power, apparent power, power factor and Energy, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel),Resonance; Introduction to three- phase circuits

### UNIT-III

Introduction to p-n junction diode and its applications. Half wave & full wave rectifiers. clipping and clamping circuits, Varactor, Varistor, Voltage Regulator  
Bipolar junction transistors and its biasing BJT operation, BJT voltages and currents, CE, CB and CC characteristics, DC load line and bias point, base bias, emitter feedback bias, collector feedback bias, voltage divider

bias, Thermal stability, biasing BJT switching circuits, transistor power dissipation and switching time, Testing of bipolar junction transistor with multi-meter, Reading datasheet of BJT.

#### UNIT-IV

Field Effect Devices: JFET : basic Operation and characteristics, drain and transfer characteristics, pinch off

Course code	BSP-101				
Category	Basic Science Course				
Course title	Physics				
Scheme and Credits	L	T	P	Credits	
	3	1	0	4	
Class work	30Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

voltage, parameters of JFET: Transconductance ( $g_m$ ), ac drain resistance ( $r_d$ ), amplification factor ( $\mu$ ), Small Signal Model & Frequency Limitations. MOSFET: basic operation, depletion and enhancement type, pinch-off voltage, Shockley equation and Small Signal Model of MOSFET, MOS capacitor.

#### Suggested books:

1. E. Huges, "Electrical Technology", ELBS.
2. J. Millman and C. Halkias, Integrated Electronics, McGraw Hill, 2<sup>nd</sup> Edition, 2009.
3. M.M. Mano: Digital Logic Design, Phi.

#### Suggested reference books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. Del Toro, "Principles of Electrical engineering", PHI.
3. Sedra and C. Smith, Microelectronic Circuits: Theory and Applications, Oxford University Press, 6<sup>th</sup> Edition, 2013.
4. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory" Pearson publishers, 10<sup>th</sup> Edition
5. R.P. Jain: Modern Digital Electronics, Tmh.
6. Malvino and Leach, "Digital Principles and Applications", TMH publishers, 8<sup>th</sup> Edition
7. Tyagi M.S., "Introduction to Semiconductor Materials and Devices", John Wiley & Sons, 1993.
8. Basic Electrical Engineering, A.E. Fitzgerald, David Higginbotham 2009, Arvin Gabel, Tata McGraw-Hill Publishing Company; 5<sup>th</sup> Edition.

## UNIT – I

Review of Atomic Structure and Statistical Mechanics: - Ideas on Atomic Structure, Quantum Mechanics, The Schrodinger Wave Equation, Statistical Mechanics, Bonding of atoms, Crystalline state. Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

## UNIT - II

Elemental and compound semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, The Hall Effect, Einstein Relations, Excess carriers in semiconductors p-n junction, Excess carriers and Quasi-Fermi Levels, Basic equations for semiconductor device operation, Solution of carrier transport equation.

## UNIT - III

P-N Junctions: - The abrupt junction (Electric field, potential, capacitance), V-I characteristic of an ideal diode, a real diode. Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices. Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

## UNIT - IV

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission. Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band- diagram.

### Suggested reference books

1. Pierret, Semiconductor Device Fundamental,
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Pearson Education
3. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
4. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
5. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley
6. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York.
7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
8. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

## UNIT-I

### Introduction:

Fundamentals of pointers in C, pointer declaration, passing pointer to functions, pointers and arrays, dynamic memory allocation, Definition of Algorithm, Data Abstraction, Performance

Course code	CSE-102				
Category	Professional Core Course				
Course title	Data Structures Using C				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Analysis & Measurement, Files and related operations in C. Data Structures vs Data Types.

### Searching and Sorting Techniques:

Searching techniques: Linear and Binary search, Sorting techniques: Selection, Bubble, Insertion, Merge sort, Quicksort, List and Table Sorting.

## UNIT-II

### Linear Data Structures- I

Arrays: Definition of array, Array storage, sparse arrays; Transpose, addition, and multiplication of sparse matrices, Stacks and Queues and their applications, expression evaluation, A mazing problem; multiple stacks and queues in an array, Application of stacks recursion polish expression and their compilation conversion of infix expression to prefix and postfix expression, Tower of Hanoi problem.

## UNIT-III

### Linear Data Structures- II

Linked Lists; definition, allocation for stacks and queues. Examples of linked lists, polynomial addition, comparison of sequential and linked allocation of storage; inversion, concatenation & copying of the lists. Implementations in C language.

Doubly Linked List: Definition of circular and doubly linked list, header node, insertion and deletion, sparse matrix, representation using doubly linked lists. Examples for application of doubly linked lists; dynamic storage management; node structures, routines for allocation and deallocation, generalized lists and recursive algorithms for copying and comparison of lists.

## UNIT-IV

### Non Linear Data Structures

Trees, Basic concepts and definitions of a tree and binary tree and associated terminology, Binary tree traversal techniques, Binary tree representation of trees, transformation of trees into binary trees, some more operations on binary trees, Binary Search Trees, Heaps and heapsort, threaded binary trees, Graphs: Representation of graphs and their traversal, Minimum cost Spanning Trees.

### BOOKS:

1. Seymour Lipschutz: Data Structures with C, Schaum's outline by TMH
2. E Horowitz and S. Sahni: Fundamentals of Data Structures in C, Second Edition, Universities Press, Hyderabad.
3. R.B. Patel: Expert Data Structures in C, Khanna Publishers,2001.
4. R.L. Kruse: Data Structures & Program Design in C, PHI.
5. D.F. Knuth: The art of Computer Programming Vol 1, Narosa Publications,1985.
6. Byron S. Gottfried & J K Chhabra: Theory and Problems of Programming with C Language, Schaum Series, TMH,2005.

Course code	CSE- 104				
Category	Professional Core Course				
Course title	Object-Oriented and python programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### UNIT-I

The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation; Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tabseparated); String manipulations: subscript operator, indexing, slicing a string.

### UNIT-II

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing

dictionaries; Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments.

### UNIT-III

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects; Encapsulation, Information hiding Method, Signature, Classes and Instances, Review of Abstraction, inheritance, polymorphism, operator overloading (`_eq_`, `_str_`, etc); abstract classes; exception handling, try block

### UNIT-IV

Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

### Reference Books

1. Phillips, Dusty. *Python 3 object-oriented programming: Build robust and maintainable software with object-oriented design patterns in Python 3.8*. Packt Publishing Ltd, 2018.
2. Steven F. Lott, *Mastering Object-Oriented Python - Second Edition*, published by Packt.
3. *Python Object Oriented Programming Cookbook*, published by Packt.
4. Mark Lutz, *Programming Python: Powerful Object-Oriented Programming*.
5. Irv Kalb, *Object-Oriented Python: Master OOP by Building Games and GUIs* Kindle Edition

Course code	EEE-101P				
Category	Engineering Science Course				
Course title	Basics of Electrical and Electronics Engineering (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: At least 8 experiments are to be performed by the students.

### List of Subject related Experiments:

1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross-sectional area of the conductor.
2. Verification of Ohm's Law, Kirchhoff current and voltage laws
3. Verification of temperature co-efficient of resistance: (i) Positive for Tungsten and Nichrome and (ii) Negative for carbon.
4. To measure DC voltage and current, AC voltage and current with multi-meter
5. To observe waveforms on oscilloscope, measure basic parameters amplitude and frequency of sine wave and square wave.
6. Obtain VI characteristics of semiconductor rectifier diode, LED, Photo-diode
7. To observe waveform at the output of half wave rectifier with and without filter capacitor.
8. To observe waveform at the output of full wave rectifier with and without filter capacitor.
9. To experimentally plot the input and output characteristics of a given BJT transistor in

- CE configuration and calculate its various parameters.
10. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
  11. To study the transfer and drain characteristics of JFET and calculate its various parameters.
  12. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.

Course code	BSP-101P				
Category	Basic Science Course				
Course title	Physics (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: At least 8 experiments are to be performed by the students.

#### **List of Subject related Experiments:**

1. To study the forward and reverse characteristics of P-N junction diode.
2. To study the characteristics of Solar cell and find out the fill factor..
3. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
4. To determine Planks constant using photocell.
5. To measure  $e/m$  of electron using helical method.
6. To find capacitance of condenser using fleshing and quenching experiment.
7. To find temperature co-efficient of platinum using Callender Griffith bridge.
8. To find out low resistance by Carry Foster bridge.
9. To find resistance of galvanometer by post office box.
10. To measure resistance using four probe methode.
11. To compare the capacitance of two capacitors using De'Sauty Bridge.

Course code	CSE-102P				
Category	Professional Core Course				
Course title	Data Structures Using C (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

**Note:** At least 8 experiments are to be performed by the students.

### **List of Subject related Experiments:**

1. Write a program to search an element in a two-dimensional array using linear search.
2. Using iteration & recursion concepts write programs for finding the element in the array using Binary Search Method
3. Write a program to perform following operations on tables using functions only  
(a) Addition (b) Subtraction (c) Multiplication (d) Transpose
4. Using iteration & recursion concepts write the programs for Quick Sort Technique
5. Write a program to implement the various operations on string such as length of string concatenation, reverse of a string & copy of a string to another.
6. Write a program for swapping of two numbers using 'call by value' and 'call by reference strategies.
7. Write a program to implement binary search tree.
8. (Insertion and Deletion in Binary search Tree)
9. Write a program to create a linked list & perform operations such as insert, delete, update, reverse in the link list
10. Write the program for implementation of a file and performing operations such as insert, delete, update a record in the file.
11. Create a linked list and perform the following operations on it  
(a) add a node (b) Delete a node

Course code	CSE-104P				
Category	Professional Core Course				
Course title	Object Oriented Concepts and Python Programming (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

**List of Subject related Experiments:**

1. Basic building blocks of a Python program (variables, conditional statements, loops, libraries, functions, errors).
2. Data structures (trees, dictionaries, tuples)
3. Object Oriented programming (classes, objects, inheritance, polymorphism, abstract classes).
4. PyQt for creating graphical user interfaces for interactive programs
5. NumPy (Matrices, vectors, linear algebra)
6. SciPy (Package for numerical computations)
7. Matplotlib (Plotting)
8. Interactive Python (IPython)

Course code	MEE-102P				
Category	Engineering Science Course				
Course title	Workshop Practices (P)				
Scheme and Credits	L	T	P	Credits	
	1	0	3	2.5	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

## COURSE OBJECTIVES

1. To impart fundamental Knowledge of engineering practices such as fitting, wood working, foundry, machining, welding, etc. for manufacturing a product.
2. To prepare the students to understand the various tools and equipment's used in these processes and their working principle
3. To impart fundamental Knowledge of Lathe machine
4. To able to understand the basic knowledge of various welding processes

### Class Work

Introduction:

Introduction to Manufacturing Processes and their Classification, Introduction to additive manufacturing, Industrial Safety.

Machining Shop

Lathe, description of lathe: headstock, tailstock, gearbox, carriage, apron, cutting speed, feed & depth of cut, cutting tools, Chucks: 3 jaw, 4 jaw.

Fitting shop:

Introduction, classification of metals: ferrous and nonferrous, fitting tools: measuring and marking tools, marking schemes for a fitting jobs, cutting tools.

Carpentry shop:

Introduction of carpentry, types of woods, carpentry tolls: measuring tools, marking tolls, cutting tools: saws, chisels, planning tools, drilling tools, striking tools, drilling tools, wood working joints, wood working lathe.

Foundry Shop

Introduction, foundry hand tools, measuring boxes, ladle, moulding, furnaces, Pattern: Types of Pattern and Allowances

Welding Shop

### **Reference Books:**

7. S K Hajra Choudhury, Nirjhar Roy, A K Hajra Choudhury, Elements of workshop Technology (vol. 1&2), Media Promoters.
8. B S Raghuwanshi, A Course in Workshop Technology (manufacturing Process vol. 1& 2) Dhanpat Rai & CO.
9. O.P. Khanna, Workshop Technology. Dhanpat Rai Publication.
10. W A J Chapman, Workshop technology in SI unit (part – 1 &2), Mc Graw Hill Education.
11. M.P. GROOVER, Principles of Modern Manufacturing, Wiley.
12. Kalpakjian, Manufacturing Process for Engineering Materials, Pearson Education India.

### **Lab Work**

#### **List of Experiments**

1. To study different types of measuring tools used in metrology and determine least counts of vernier callipers, micrometres and vernier height gauges.
2. To study different types of machine tools (lathe, shaper, planer, milling, drilling machines)
3. To prepare a job on a lathe involving like facing, outside turning, taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare a job made out of MS Flats, making saw – cut filling V-cut taper at the corners.
6. To prepare lay out on a metal sheet by making and prepare rectangular tray pipe shaped components e.g. funnel.
7. To prepare joints for welding suitable for butt welding and lap welding.
8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
9. To prepare simple engineering components/shapes by forging.
10. To prepare mold and core assembly.
11. To prepare horizontal surface/vertical surface/curved surface/slats or V-grooves on a shaper/planner.
12. To prepare a job involving side and face milling on a milling
13. To prepare a job on CNC Machine/Additive Manufacturing.

**Note :** At least eight experiments/jobs are to be performed/prepared by the students in the semester.

## Class work

Course code	CSE-103P				
Category	Engineering Science Course				
Coursetitle	Engineering Graphics (Web Designing)				
Scheme and Credits	L	T	P	Credits	
	1	0	2	2	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Brief history of Internet, introduction to world wide web, basic principles involved in developing a web site, rules of web designing, web standards, audience requirements, Design concept.

Introduction to elements of HTML, XHTML and CSS.

Javascript as programming language, Language Syntax: Data types, Values, Variables, Expressions and Operators. JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure.

Introduction of Google Web Designer, Firefox, Wordpress, sublime text, Angular.JS, jQuery etc.

**Note:** At least 8 experiments are to be performed by the students.

## Lab work

### List of Subject related Experiments:

1. Prepare a survey document of ten website which you like and dislike with various reasons. (Prerequisite)
2. Introduction to basic HTML elements
3. Use table tag to format web page. Also create the Time Table of your class using table tag.
4. Create your profile page i.e. educational details, Hobbies, Achievement, My Ideals etc.
5. Create Style sheet to set formatting for text tags and embed that style sheet on web pages created for your site.
6. Design a web page and embed various multimedia features in the page.
7. Design signup form to validate username, password, and phone numbers etc using Java script.
8. Write a JavaScript program to determine whether a given year is a leap year in the Gregorian calendar.
9. Write a JavaScript program to convert temperatures to and from celsius, Fahrenheit.
10. Installation of Wordpress and designing the wordpress site.
11. Introduction to Dreamweaver and setting up site using Dreamweaver.
12. Submission of Website with Report.

# 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		Discrete Mathematics	3	0	0	3	3	30	70	-	100	3
2.	BSC		Aptitude Reasoning- I	3	0	0	3	3	30	70	-	100	3
3.	ESC		Digital Electronics	3	0	0	3	3	30	70	-	100	3
4.	PCC		R Programming	3	0	0	3	3	30	70	-	100	3
5.	PCC		Operating System	3	0	0	3	3	30	70	-	100	3
6.	PCC		Database Management System	3	0	0	3	3	30	70	-	100	2
7.	LC		Digital Electronics Lab	0	0	2	2	1	50	-	50	100	2
8.	LC		R Programming Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Operating System Lab	0	0	2	2	1	50	-	50	100	2
10.	LC		Database Management System Lab	0	0	2	2	1	50	-	50	100	2
			Total	18	0	8	26	22	310	490	200	1000	

**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.

## DISCRETE MATHEMATICS

Semester	III
Course code	

Category	Basic Science courses				
Course title	Discrete Mathematics				
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 basic theoretical concepts of set theory, functions, and relations.
2. To understand the basic theoretical concepts of logic systems and Boolean algebra.
3. To express real-life problem of basic counting techniques and recurrence relations, algebraic structures.
4. The use of graphs theory concepts in real-life examples.

### **UNIT I SET THEORY, RELATIONS, FUNCTIONS, LOGIC AND PROPOSITIONAL CALCULUS**

**Set Theory:** Introduction to set theory, Venn diagrams, Set operations, Algebra of sets, Duality, Finite and infinite sets, Counting principles, Power sets, Partitions, and Multi sets.

**Relations:** Cartesian product, Representation of relations, Types of relation, Binary relation, Equivalence relations, Partitions, Partial ordering relations, POSET, Hasse diagram, Lattices and its types.

**Functions:** Definition, Types of functions, Bijective functions, Composition of functions, Inverse functions, recursively defined functions, Finite and infinite sets, Countable and uncountable sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

**Logic And Propositional Calculus:** Introduction, Propositions and compound propositions, Logical operations, Propositions and truth tables, Tautologies, Contradictions, Logical equivalence, Algebra of propositions, Conditional and Bi-conditional statements, The use of Quantifiers.

### **UNIT II BASIC COUNTING TECHNIQUES AND RECURRENCE RELATION**

**Basic Counting Techniques:** Pigeon-hole principle, Permutation and Combination, the Division algorithm: Prime Numbers, The GCD: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

**Recursion And Recurrence Relation:** Polynomials and their evaluation, Sequences, Introduction to AP, GP and AG Series, Partial Fractions, Recurrence Relation, Linear Recurrence Relations with constant Coefficients, Linear Homogeneous Recurrence Relations with Constant Coefficients, Particular Solution-Homogeneous Linear Difference Equations, Non-Homogeneous Linear Difference Equations, Total Solution, solving recurrence relation using generating functions.

### **UNIT III ALGEBRAIC STRUCTURES**

**Definitions and examples of Algebraic Structures with one Binary Operation:** Semi Groups, Monoids, Groups, Semigroups, Subgroups, Abelian groups, Cosets, Normal Subgroup, Cyclic groups, Congruence Relation and Quotient Structures, Permutation Groups, Lagrange's Theorem, Homomorphism, Isomorphism, Automorphism.

**Definitions and examples of Algebraic Structures with two Binary Operation:** Rings, Integral Domain, Fields; Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

### **UNIT IV GRAPHS THEORY**

**GRAPHS THEORY:** Introduction to graphs and their properties, Degree, Connectivity, Path, Cycle, Directed and undirected graphs, Subgraph, Bipartite Graphs, Regular Graphs, Connected Graphs, Multigraph and Weighted graph, Homomorphic and Isomorphic graphs, cut points and bridges, Paths and circuits, shortest path algorithm for weighted graphs, Eulerian paths and circuits, Hamiltonian path and

circuits, Planar Graphs, Euler's formulae, Graph Colouring.

### **COURSE OUTCOMES:**

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

CO1: To solve mathematical problems based on concepts of set theory, relations, functions and lattices.

CO2: To express logical sentences in terms of quantifiers and logical connectives.

CO3: To apply basic counting techniques to solve permutation and combination problems. CO4: To solve recurrence relations.

CO5: To classify the algebraic structure of any given mathematical problem.

CO6: To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

CO7: To develop the given problem as graph networks and solve it with techniques of graph theory.

### **TEXT AND REFERENCE BOOKS:**

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, 6th Edition, Tata McGraw Hill, 2011.
2. Satinder Bal Gupta: *A Text Book of Discrete Mathematics and Structures*, University Science Press, Delhi.
3. C. L. Liu and D. P. Mohapatra, *Elements of Discrete Mathematics A Computer Oriented Approach*, Tata McGraw Hill, 3rd Edition, 2008.
4. J.P. Trembley and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill – 13th reprint, 2012.
5. Richard Johnsonbaugh, *Discrete Mathematics*, 6th Edition, Pearson Education Asia, 2011.
6. S. Lipschutz and M. Lipson, *Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, 2010.
7. B. Kolman, R. C. Busby and S. C. Ross, *Discrete Mathematical structures*, 6th Edition, PHI, 2010.

## **APTITUDE REASONING – I**

Semester	III			
Course code				
Category	BSC			
Course title	Aptitude Reasoning- I			
Scheme and Credits	L	T	P	Credits
	3	0	0	3
Class work	30 Marks			
Exam	70 Marks			
Total	100 Marks			

Duration of Exam	03 Hours
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**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.

**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.

#### 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,

#### 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 4 th 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 OBJECTIVE:**

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 II 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 III 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 IV 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:**

R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

M. M. Mano, "Digital logic and Computer Design", Pearson Education India, 2016.

A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Nasib Singh Gill and J B Dixit, "Digital Design and Computer Organization", University Science Press, New Delhi

## **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.

## **R – PROGRAMMING**

Semester	III				
Course code					
Category	Engineering Science Course				
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.

## **R – PROGRAMMING LAB**

Semester	III				
Course code					
Category	Engineering Science Course				
Course title	R - Programming 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. Write a R program to take input from the user (name and age) and display the values.
2. Write a R program to get the details of the objects in memory.
3. Creating a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
4. Creating a simple bar plot of five subjects marks.
5. Get the unique elements of a string and unique numbers of vectors
6. Appending value to a given empty vector
7. Multiplying two vectors of integer type and length 3
8. Find the sum, mean and product of a vector, ignoring elements like NA and NaN.
9. To create three vectors a,b,c with 3 integers. Combine three vectors to become a 3\*3 matrix where each column represents a vector. Print the content of the matrix
10. Program to create a matrix from a list of given vectors

### **COURSE OUTCOMES:**

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

- CO1: Understanding the types, classes and functions of R Programming.
- CO2: Accessing and Processing of Data.
- CO3: Understanding the I/O interface programming.
- CO4: Study and Analyse Data Visualisation.
- CO5: Implement any application level simulation using R.

## 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, 2<sup>nd</sup> Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8<sup>th</sup> Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

## **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				

### **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.

## DATABASE MANAGEMENT SYSTEMS

Semester	III			
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

**DATABASE MANAGEMENT SYSTEM LAB**

Semester	III
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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)
11. Inventory Control System
12. Material Requirement Processing.
13. Hospital Management System.
14. Railway Reservation System.
15. Personal Information System.
16. Web-Based User Identification System.
17. Time Table Management System.
18. 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.

## B. Tech. (Computer Science and Engineering- Artificial Intelligence)

Scheme of Studies/Examination w.e.f. 2023-24

# Semester - IV

S.No.	Category	Course	Course Title	Hours Per week	Total	Credits	Examination Schedule (Marks)	
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		Code		L	T	P	Contact Hrs. per week		Marks of classwork	Theory	Practical	Total	Duration of Exam (Hours)
1.	BSC		Aptitude Reasoning-II	3	0	0	3	3	30	70	-	100	3
2.	PCC		Foundation of Machine Learning	3	0	0	3	3	30	70	-	100	3
3.	PCC		Computer Architecture and Organization	3	0	0	3	3	30	70	-	100	3
4.	PCC		Analysis and Design of Algorithms	3	0	0	3	3	30	70	-	100	3
5.	PCC		Predictive Analytics	3	0	0	3	3	30	70	-	100	
6.	PCC		Applied AI and Expert System	3	0	0	3	3	30	70	-	100	3
7.	LC		Foundation of Machine Learning Lab	0	0	2	2	1	50	-	50	100	2
8.	LC		Applied AI and Expert System Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Analysis and Design of Algorithms Lab	0	0	2	2	1	50	-	50	100	2
10.	AU		*Indian Constitution	3	0	0	3	0	30	70	-	-	2
			<b>Total</b>	<b>21</b>	<b>0</b>	<b>6</b>	<b>27</b>	<b>21</b>	<b>360</b>	<b>490</b>	<b>150</b>	<b>900</b>	

**\*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- II

Semester	IV			
Course code				
Category	BSC			
Course title	Aptitude Reasoning- II			
Scheme and Credits	L	T	P	Credits
	3	0	0	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.

**Learning 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 I.** Average, Problems on Ages, Surds & Indices, Percentages, Problems on Numbers,

#### UNIT II

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

#### UNIT III

**Data Interpretation.** Data Interpretation, Pie Chart, Venn Diagrams

#### UNIT IV

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

### 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

## Foundation Of Machine Learning

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Foundation of Machine Learning				
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 teach the theoretical foundations of various learning algorithms.
- 2.To train the students better understand the context of supervised and unsupervised learning through real-life examples.
- 3.To understand the need for Reinforcement learning in real – time problems.  
Apply all learning algorithms over appropriate real-time dataset.
- 4.Evaluate the algorithms based on corresponding metrics identified.

### **Course Outcome**

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

- 1.Understand, visualize, analyze and preprocess the data from a real-time source.
- 2.Apply appropriate algorithm to the data.
- 3.Analyze the results of algorithm and convert to appropriate information required for the real – time application.
- 4.Evaluate the performance of various algorithms that could be applied to the data and to suggest most relevant algorithm according to the environment.

### **UNIT I Introduction to Machine Learning and Pre- requisites**

Introduction to Machine Learning – Learning Paradigms – PAC learning – Version Spaces – Role of Machine Learning in Artificial Intelligence applications.

### **UNIT II Supervised Learning – I & Supervised Learning – II**

#### **Supervised Learning**

Linear and Non-Linear examples – Multi-Class & Multi-Label classification – Linear Regression – Multiple Linear Regression – Naïve Bayes Classifier – Decision Trees – ID3 – CART – Error bounds.

#### **Supervised Learning – II**

K-NN classifier – Logistic regression – Perceptron – Single layer & Multi-layer – Support Vector Machines – Linear & Non-linear – Metrics & Error Correction.

### **UNIT III Unsupervised Learning & Ensemble Learning**

#### **Unsupervised Learning**

Clustering basics (Partitioned, Hierarchical and Density based) - K-Means clustering – K- Mode clustering – Self organizing maps – Expectation maximization – Principal Component Analysis – Kernel PCA – tSNE (t-distributed stochastic neighbor embedding) - Metrics & Error Correction.

#### **Ensemble Learning**

Bias – Variance Tradeoff – Bagging and Boosting (Random forests, Adaboost, XG boost inclusive) – Metrics & Error Correction.

### **UNIT IV Machine Learning in Practice & Reinforcement Learning (RL)**

**Machine Learning in Practice** Class Imbalance – SMOTE – One Class SVM – Optimization of hyper parameters.

**Reinforcement Learning (RL)** Basics of RL – RL Framework – Markov Decision Process – Exploration Vs Exploitation - Policies, Value Functions and Bellman Equations – Solution Methods – Q-learning.

**Text Book(s)**

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Prentice Hall of India, Third Edition 2014.
2. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction (Adaptive Computation and Machine Learning series) 2<sup>nd</sup> edition, A Bradford Book; 2018.

**Reference Books**

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
2. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition, 1997.
3. Charu C. Aggarwal, Data Classification Algorithms and Applications, CRC Press, 2014

## Foundation Of Machine Learning Lab

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Foundation of Machine Learning Lab				
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				

**Course Objectives**

1. To teach the theoretical foundations of various learning algorithms.
2. To train the students better understand the context of supervised and unsupervised learning through real-life examples.
3. To understand the need for Reinforcement learning in real – time problems.
4. Apply all learning algorithms over appropriate real-time dataset.
5. Evaluate the algorithms based on corresponding metrics identified.

## Course Outcome

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

1. Understand, visualize, analyze and preprocess the data from a real-time source.
2. Apply appropriate algorithm to the data.
3. Analyze the results of algorithm and convert to appropriate information required for the real – time application.
4. Evaluate the performance of various algorithms that could be applied to the data and to suggest most relevant algorithm according to the environment.

## List Of Experiments

1. Linear & Multiple Linear Regression
2. Naïve Bayes classifier
3. Decision trees – ID3 & CART
4. Logistic regression
5. Support Vector Machines – Linear & Non-linear
6. Single & Multilayer Perceptron
- 7.K-NN, K-Means & K-mode clustering
- 8.Random – forest
9. Adaboost, XGboost
10. Principal component analysis
11. Self – Organizing maps
12. Q-Learning

## 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, de-coder), 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 Edi, 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 Edi, 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

## ANALYSIS AND DESIGN OF ALGORITHMS

Semester	IV			
Course code				
Category	Professional Core Courses			
Course title	Analysis and design of Algorithms			
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 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 I

**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 II

**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 III

**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 IV

**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 OUTCOMES:

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

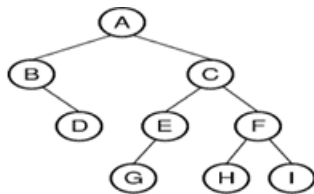
1. Algorithm Design, Jon Kleinberg and Eva Tardos, 1st Edition, Pearson Education 2014.
2. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing 2018.
3. Fundamentals of algorithms, Horowitz E, Sahini S, Rajasekaran S., University Press 2008.
4. Introduction to algorithms, Cormen, 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.

## ANALYSIS AND DESIGN OF ALGORITHMS LAB

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Analysis and Design of Algorithms 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. 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:

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

CO1: Develop and code program for the algorithms and analyze it to determine its computational complexity.

CO2: Identify and analyze worst-case running times of algorithms.

CO3: Model given engineering problem using graph and trees and write the corresponding algorithm to solve the problems.

CO4: Identify and apply the suitable algorithm for the given real-world problem.

## PREDICTIVE ANALYTICS

Semester	IV			
Course code				
Category	Professional Core Courses			
Course title	<b>Predictive Analytics</b>			
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 provide the knowledge of various quantitative and classification predictive models based on various regression and decision tree methods.
2. To provide the knowledge to select the appropriate method for predictive analysis
3. To provide the understanding of how to search, identify, gather and pre-process data for the analysis.
4. To provide the understanding of how to formulate predictive analytics questions.

#### Unit I

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions, Weighted Least Squares (WLS), Generalized Linear Models (GLM).

#### Unit II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis. Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models.

#### Unit III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations, Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

#### Unit IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods. Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).

Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

**COURSE OUTCOMES:**

1. Ability to develop and use various quantitative and classification predictive models based on various regression and decision tree methods.
2. Ability to select the appropriate method for predictive analysis
3. Ability to search, identify, gather and pre-process data for the analysis.
4. Ability to formulate predictive analytics questions.

**Text books/Reference books:**

1. “An Introduction to Statistical Learning: with Applications in R” by James, Witten, Hastie and Tibshirani, Springer, 1st. Edition, 2013.
2. “The Elements of Statistical Learning-Data Mining, Inference, and Prediction “ by Trevor Hastie, Robert Tibshirani, Jerome Friedman , Second Edition , Springer Verlag, 2009.
3. Predictive & Advanced Analytics (IBM ICE Publication)

# APPLIED ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Applied artificial intelligence and expert systems				
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				

**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 Basic Concepts of Artificial Intelligence and Expert Systems.
2. To provide knowledge on Various Techniques and Tools involved in Artificial Intelligence.

### UNIT I

Introduction: History, Definition of AI, Emulation of human cognitive process, knowledge search trade off, stored knowledge, semantic nets. An abstract view of modelling, elementary knowledge. Computational logic, analysis of compound statements using simple logic connectives, predicate logic, knowledge organization and manipulation, knowledge acquisition.

### UNIT II

PROGRAMMING AND LOGICS IN ARTIFICIAL INTELLIGENCE LISP and other programming languages- introduction to LISP, syntax and numerical function, LISP and PROLOG distinction, input output and local variables, Interaction and recursion, property list and arrays alternative languages, formalized symbolic logics properties of WFRS, non-deductive inference methods. Inconsistencies and uncertainties Truth maintenance systems, default reasoning and closed world assumption, Model and temporary logic.

### UNIT III

SEARCH METHODS AND KNOWLEDGE REPRESENTATION Fuzzy logic - concepts, Introduction to Fuzzy logic with examples, probabilistic reasoning, Bayesian probabilistic inference, Dempster Shafer theory, possible world representation, AdHoc methods. Structure knowledge: Graph, frames and related structures, Object oriented representation- object classes, message and methods, simulation examples using OOPS programs, OOP languages. Search and control strategies - Concepts, search problems, uniformed or Blined search, searching AND – OR graphs.

### UNIT IV

KNOWLEDGE ORGANISATION AND COMMUNICATION IN EXPERT SYSTEMS Matching techniques- Need for matching, matching problem, partial matching, Fuzzy matching, RETE matching algorithm. Knowledge organization- Indexing and retrieval techniques, integration of knowledge in memory organization systems, Perception, communication and Expert systems. Overview of Linguistics, Basic passim techniques, semantic analysis and representation structures, natural language generation and system.

## COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Understand the Basics about Artificial Intelligence and Expert Systems.

CO2 - Understand the Programming Logics in Artificial Intelligence.

CO3 - Understand Various search methods in Artificial Intelligence.

CO4 - Understand the Knowledge about the Expert Systems.

CO5 - Understand The Image processing and analysis.

CO6 - Understand the latest developments in Knowledge systems and Tools.

### **TEXT / REFERENCE BOOKS**

1. Russel (Stuart), 'Artificial Intelligence- Modern approach, Pearson Education series in AI', 3rd Edition, 2009.
2. Dan W Patterson, 'Introduction to Artificial intelligence and Expert systems', Prentice Hall of India Pvt. Ltd,2001
3. Eugene Charniak, Drew Mc Dermot, 'Introduction to Artificial intelligence', Addison Wesley Longman Inc.,2009
4. George. F, William. A. Stubblefield, 'Artificial intelligence and the design of expert systems', The Benjamin Cummins Publishing Co., Inc 2nd Edition, 1992.
5. Robert J Schalkoff, 'Artificial intelligence An Engineering Approach', McGraw Hil International Edition, 1990  
International Edition, 1990

### **APPLIED AI AND EXPERT SYSTEMS LAB**

Semester	IV
Course code	

Category	Professional Core Courses				
Course title	Applied Ai And Expert Systems 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				

List of Experiments:

1. Write a program to implement DFS
2. Write a program to implement BFS
3. Write a Program to find the solution for travelling salesman Problem
4. Write a program to implement Simulated Annealing Algorithm
5. Write a program to find the solution for wampus world problem
6. Write a program to implement 8 puzzle problem
7. Write a program to implement Towers of Hanoi problem
8. Write a program to implement A\* Algorithm
9. Write a program to implement Hill Climbing Algorithm
10. Build a bot which provides all the information related to you in college.

## INDIAN CONSTITUTION

Semester	IV				
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.

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)**  
**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		Computer Networks	3	0	0	3	3	30	70	-	100	3
2.	PCC		Theory of Computation	3	0	0	3	3	30	70	-	100	3
3.	PCC		Natural Language Processing	3	0	0	3	3	30	70	-	100	3
4.	PCC		Data Mining and	3	0	0	3	3	30	70	-	100	3

			Warehousing										
5.	PCC		Text & Web Intelligence	3	0	0	3	3	30	70	-	100	3
6.	PEC		*Professional Elective Course-I	3	0	0	3	3	30	70	-	100	3
7.	OEC		*Open Elective Course-I	3	0	0	3	3	30	70	-	100	3
8.	LC		Computer Networks Lab	0	0	2	2	1	50	-	50	100	2
9.	LC		Text and Web Intelligence Lab	0	0	2	2	1	50	-	50	100	2
10.	LC		Data Mining and Warehousing Lab		0	2	2	1	50	-	50	100	3
11.	TRAINING		Practical Training-I			4	4	1	50	-	50	100	3
			<b>Total</b>	<b>21</b>	<b>0</b>	<b>10</b>	<b>31</b>	<b>25</b>	<b>410</b>	<b>490</b>	<b>200</b>	<b>1100</b>	

**\*NOTE:**

**1. Choose any one from Professional Elective Course – I**

**2. Choose any one from Open Elective Course – I**

**Professional Elective Course – I**

1. Wireless & mobile networks
2. Mobile application development for AI
3. Introduction to Cloud Computing
4. Distributed Databases

## COMPUTER NETWORKS

Semester	V			
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, 4<sup>th</sup> Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8<sup>th</sup> 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.

## COMPUTER NETWORK LAB

Semester	V			
Course code				
Category	Professional Core Courses			
Course title	Computer Networks Lab			
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			

### 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

#### List of Experiments

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

## THEORY OF COMPUTATION

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Theory of Computation				
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 basic concepts of formal languages and automata theory.
2. To study the types of Automata i.e., NFA, DFA, NFA with  $\epsilon$ -transition and their interconversion methods and importance.
3. To Study formal languages of different kinds, such as regular and context-free languages. Understand the concept of grammar and its types. Removal of ambiguity and reduced form and Normal forms of grammar.
4. To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA & Turing machine.
5. To study the various properties of Turing machines and their design.

### COURSE OUTCOMES:

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

CO1: Define terminology related to the theory of computation.

CO2: Explain the basic concepts and applications of Theory of Computation.

CO3: Apply the principles of Theory of Computation to solve computational problems.

CO4: Compare and contrast the hierarchy of grammars.

CO5: Design various types of automata for given problems.

CO6: To solve various problems of applying normal form techniques, push-down automata, and Turing Machines.

### UNIT - I

**Finite Automata:** Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Non-Deterministic finite automata (NFA), Equivalence of DFA and NFA, Conversion of NFA to DFA, minimization of finite automata, Finite automata with  $\epsilon$ - moves, Acceptability of a string by a finite Automata.

**Introduction to Machines:** Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

### UNIT - II

**Regular Expression:** State and prove Arden's Method, Regular Expressions, Recursive definition of the regular expression, Regular expression conversion to Finite Automata, and vice versa.

**Properties of regular languages:** Regular language, pumping lemma for regular sets/languages, Application of regular languages.

### UNIT - III

**Grammars:** Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal,

Reduced Forms: Removal of useless symbols, null and unit productions, Normal Form: Chomsky Normal form (CNF) and Greibach Normal Form (GNF),

**Push Down Automata:** Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

### UNIT - IV

**Turing machines:** The basic model for Turing machines I, Deterministic and Non- Deterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by a designed Turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

**Undecidability:** Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

#### TEXT AND REFERENCE BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3<sup>rd</sup> edition, Cengage Learning.
3. K. L. P Mishra, N. Chandrashekar (2003), Theory of Computer Science-Automata Languages and Computation, 2<sup>nd</sup> edition, Prentice Hall of India, India.
4. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
5. John C. Martin: Introduction to Languages and Automata Theory, 3<sup>rd</sup> edition, Tata McGraw- Hill, 2007

# NATURAL LANGUAGE PROCESSING

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Natural Processing Language				
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:** The main objective of this course is to give a practical introduction to NLP. It deals with morphological processing, syntactic parsing, information extraction, probabilistic NLP and classification of text using Python's NLTK Library.

## COURSE OUTCOMES:

At the end of the course the student will be able to

- Write Python programs to manipulate and analyze language data
- Understand key concepts from NLP and linguistics to describe and analyze language
- Understand the data structures and algorithms that are used in NLP
- Classify texts using machine learning and deep learning

### Unit-I

**Language Processing and Python:** Computing with Language: Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding.

**Accessing Text Corpora and Lexical Resources:** Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet.

### Unit-II

**Processing Raw Text:** Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings.

**Categorizing and Tagging Words:** Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word.

### Unit-III

**Learning to Classify Text:** Supervised Classification, Evaluation, Naive Bayes Classifiers.

**Deep Learning for NLP:** Introduction to Deep Learning, Convolutional Neural Networks, Recurrent Neural Networks, Classifying Text with Deep Learning.

### Unit-IV

**Extracting Information from Text**

Information Extraction, Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

## **Analyzing Sentence Structure**

Some Grammatical Dilemmas, What's the Use of Syntax. Context-Free Grammar, Parsing with Context-Free Grammar.

### **References:**

1. Natural Language Processing with Python. Steven Bird, Ewan Klein, and Edward Lope, O'Reily, 2009
2. Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Akshay Kulkarni, Adarsha Shivananda, Apress, 2019

### **Suggested Reading:**

3. Allen James, Natural Language Understanding, Benjamin/Cumming,1995.
4. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

## DATA MINING AND WAREHOUSING

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Data Mining and Warehousing				
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 expand students' knowledge and skills gained in Data Mining and Warehousing courses and look in depth at data warehousing and data mining methods. The course examines the database architecture and technologies required for solving complex problems of data and information management, information retrieval, and knowledge discovery facing modern organizations. Case studies of organizations using these technologies to support business intelligence gathering and decision making are examined. This course also provides hands-on experience with state-of-the-art data warehousing and data mining methods and tools.

### **COURSE OUTCOMES:**

After the completion of the course the students will be able

- CO1. To understand Concept of Data Mining, Data warehousing and schemas for multidimensional Databases.
- CO2. To understand Basic Statistics in order to apply data mining techniques.
- CO3. To analyse the data, identify the problems, and choose the relevant models and algorithms to apply.
- CO4. To combine and consolidate data from various databases scattered throughout a company into a Datawarehouse.
- CO5. To characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

### **UNIT-I**

#### **BASIC STATISTICS:**

Statistical descriptions of data: mean, median, mode, Measuring dispersion of data: range, quartiles, variance, standard deviation, chi-square test, Correlation coefficient and covariance, Regression analysis.

### **UNIT-II**

#### **DATA PREPROCESSING:**

Introduction to Data preprocessing, Need to preprocess the data, Data cleaning: missing values, Data integration: Redundancy, Data reduction and its strategies, Data transformation and discretization, Strategies of data transformation.

### **UNIT-III**

#### **INTRODUCTION TO DATA MINING AND ITS ALGORITHMS:**

Introduction to Data Mining and algorithms, Processes, Market Basket Analysis, The Apriori Algorithm, Decision Tree.

## **INTRODUCTION TO DATA WAREHOUSING AND DATA WRANGLING:**

Data Warehouse, Difference between Operational Database systems and Data Warehouse, From Table and Spreadsheets to Data Cubes, Schemas for Multidimensional Databases: Star, Snowflakes and Fact Constellations, Data Wrangling, Combining and Merging DataSets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions (Regex)

## **UNIT-IV**

### **ETL:**

ETL Phase 1 Data Wrangling before the Load, ETL Phase 2 Step-by-step guide to uploading data using SSIS, Handling errors during ETL Phases 1,2, ETL Phase 3 Data Wrangling after the load, Handling errors during ETL Phase 3, Different types of ETL tools.

### **TEXT AND REFERENCE BOOKS:**

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.
2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006
4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

## DATA MINING & WAREHOUSING LAB

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	DATA MINING & WAREHOUSING 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:

1. Learn how to build a data warehouse and query it (using open-source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open-source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
5. Exercise the data mining techniques with varied input values for different parameters.
6. To obtain Practical Experience Working with all real data sets.

### COURSE OUTCOMES:

1. Ability to add mining algorithms as a component to the existing tools
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to apply mining techniques for realistic data.
- 1 Installation of WEKA Tool
- 2 Creating new Arff File
- 3 Pre-Processes Techniques on Data Set 16 Pre-process a given dataset based on Handling Missing Values
- 4 Generate Association Rules using the Apriori Algorithm
- 5 Generating association rules using fp growth algorithm
- 6 Build a Decision Tree by using J48 algorithm
- 7 Naïve bayes classification on a given data set
- 8 Applying k-means clustering on a given data set
- 9 Calculating Information gains measurs
- 10 OLAP Cube and its different operations
- 11 Case Study: Create Student. ariff file to suggest better college using Decision tree
- 12 Case Study: Create Placement.ariff file to identify the students who are eligible for placements using KNN

## TEXT AND WEB INTELLIGENCE

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Text and Web Intelligence				
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 of information retrieval systems and its technologies
2. Process structured and unstructured data
3. Mining text and learning different analyzing techniques
4. Learning different techniques for textual and nontextual data

### COURSE OUTCOMES:

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

- CO1. To understand the concepts of Boolean retrieval utilized in Information retrieval system and acquire the ability to Process Unstructured Data.
- CO2. To get an overview of text mining and analytics with different techniques of finding similarity.
- CO3. To comprehend the building and evaluation of Supervised and Unsupervised Categorization Models.
- CO4. To analyse the concepts of opinion and sentiment analysis
- CO5. To apply the techniques for joint mining textual and non-textual data.

### UNIT - I

#### INTRODUCTION AND DATA PREPROCESSING:

Introduction to the course, Introduction with example of Information retrieval problem, Boolean Retrieval (Term Incidence Matrix, Inverted Index, Dictionary-Postings list, Processing Boolean Queries, Skip Pointers), Preprocessing steps (Tokenization, stop word removal, normalization, stemming, lemmatization, part of speech tagging), wildcard queries

### UNIT - II

#### OVERVIEW OF TEXT MINING AND ANALYTICS:

Overview of Text Mining and Analytics, Paradigmatic Relation Discovery, syntagmatic relation discovery, cosine similarity, tf-idf calculation, PLSA, LDA

### UNIT - III

#### SENTIMENT ANALYSIS AND OPINION MINING:

Introduction to Sentiment Analysis, sentiment classification, opinion mining. Python NLTK Sentiment Analysis, Recommendation Systems and its working

## **UNIT - IV**

### **CASCADING AND DIFFUSION IN NETWORKS:**

Introduction to web Analytics, Web mining process and techniques- data collection, web scraping, Ranking Techniques: Page Rank and HITS

### **TEXT AND REFERENCE BOOKS:**

Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press, 2008

Tony Ojeda, Rebecca Bilbro, Benjamin Bengfort, Applied Text Analysis with Python, O'Reilly Media, June 2018.

Web Analytics for dummies, by Pedro Sostr and Jennifer LeClaire, Wiley Publishing, Inc.

Ashok N. Shrivastva, Mehran Sahami, Text Mining: Classification, Clustering and Applications; CRC Press, edition 2010.

## **TEXT AND WEB INTELLIGENCE LAB**

Semester	V				
Course code					
Category	Lab Courses				
Course title	Text and Web Intelligence 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 OUTCOMES:**

- CO1. Apply the basic concepts of Web mining using NLTK
- CO2. Utilizing regular expression to retrieve and mining information
- CO3. To understand and apply different stemming and lemmatization techniques
- CO4. To capture and contrast different clustering methodologies
- CO5. To work on HTML markups

### **EXPERIMENTS**

1. Consider the input string - “Joe waited for the train. The train was late. Mary and Samantha took the bus. I looked for Mary and Samantha at the bus station.”
  - Write a Python NLTK program to split the text sentence/paragraph into a list of words.
  - Write a Python NLTK program to create a list of words from a given string. Consider same input as in the previous question.
  - Write a Python NLTK program to split all punctuation into separate tokens.
2. Write a Python NLTK program to tokenize words, sentence wise.
3. Write a Python NLTK program to remove Twitter username handles from a given twitter text. Consider input string as: "@abcd @pqrsNoSQL introduction - w3resource <http://bit.ly/1ngHC5F> #nosql #database #webdev".
4. Write a Python NLTK program to find parenthesized expressions in a given string and divide the string into a sequence of substrings.
5. Use PorterStemmer() to perform Stemming on the list. Input = ["program", "programs", "programer", "programing", "programers"]
6. Apply SnowballStemmer on the previous input.
7. Perform lemmatization on the list. Input = ["program", "programs", "programer", "programing", "programers"]
8. Write a program to strip away HTML markup with the help of the BeautifulSoup library, and use regular expressions to remove open and close double brackets and anything in between them.
9. Write a program to Normalize the data and remove non-ASCII characters from a list of normalized tokens.
10. Write a program to remove accented characters

**PROFESSIONAL  
ELECTIVE COURSE – I**

## WIRELESS & MOBILE NETWORKS

Semester	V				
Course cod					
Category	Professional Elective Course – I				
Course title	Advanced wireless & mobile 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.

### Unit I

Fundamentals of Wireless Communication Technology: Overview and Applications/types of Wireless and Mobile Networks; Evolution and Challenges of Wireless Networks; The Electromagnetic Spectrum; Spread Spectrum; Frequency Reuse; Radio Propagation Mechanisms, Signals, Antennas; Characteristics of Wireless Channels; Modulation Techniques and Multiple Access Techniques for Wireless Systems.

Wireless LANs & PANs: Use and Design Goals for WLANs; IEEE802.11 standard: Architecture, Infrastructure vs. Ad-hoc Modes, Physical & MAC layer, CSMA/CA mechanism; HIPERLAN 1/2 standards; Technical features of HOMERF; BLUETOOTH specifications and architecture; Introduction to other PAN technologies and their applications.

### Unit II

Wireless WANs & MANs: The Cellular Concept; Call Set-up; Frequency Reuse Channel Allocation Algorithms; Handoffs; Mobility Management.

Telecommunication Systems: GSM and IS-95 architecture, channels and Call Establishment; Wireless Data Service; Generations in Wireless Cellular Networks and their features; DECT, TETRA, UMTS; Satellite Systems.

### Unit III

AdHoc Wireless Networks: Introduction; Applications & Design Issues.

MAC Protocols for Ad Hoc Wireless Networks: Issues, design Goals and Classification; Contention Based Protocols; Contention Based MAC Protocols with Reservation and Scheduling Mechanism; Other MAC Protocols.

Routing Protocols for Ad Hoc Networks: Introduction, Issues; Classification; Table-Driven Routing Protocols; On-Demand Routing Protocols; Hybrid Routing Protocols; Routing Protocols with Efficient Flooding Mechanisms; Hierarchical Routing Protocols.

### Unit IV

Multicast Routing in Ad Hoc Networks: Introduction; Issues; Operation of Multicast Routing Protocols; Classification; Tree-Based Multicast Routing Protocols; Mesh-Based Multicast Routing Protocols; Energy Efficient Multicasting.

Energy Management in Ad Hoc Wireless Networks: Need and classification of energy management schemes.

Transport Layer for Ad Hoc Wireless Networks: Introduction and Design Issues; TCP over Ad Hoc Wireless Networks.

Security Requirements in wireless networks: Issues and challenges; Network Security Attacks; Key Management; Secure Routing in Ad Hoc Wireless Networks; WEP protocol.

## MOBILE APPLICATIONS DEVELOPMENT FOR AI

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Mobile applications development for AI				
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

**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
7. Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, Apress, latest edition.
8. Jochen Schiller, “Mobile Communications”, Addison-Wesley, latest edition
9. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028.

# INTRODUCTION TO CLOUD COMPUTING

Semester	V				
Course cod					
Category	Professional Elective Course – I				
Course title	Introduction to Cloud 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 OBJECTIVES (CEOS):**

To make students familiar with:

2. To provide students with the fundamentals and essentials of Cloud Computing.
3. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
4. To enable students exploring some important cloud computing driven commercial systems and applications.
5. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

### UNIT I

**Introduction of Cloud Computing:** What is Cloud Computing?, How it works? Cloud Computing Delivery Models and Services, Ethical issues in Cloud Computing, Cloud Vulnerabilities, Major Challenges faced by Cloud Computing

### UNIT II

#### **Parallel and Distributed Systems:**

Parallel and Distributed Systems Introduction, Parallel Computing, Architecture, Distributed Systems, Communication Protocol and Process Coordination, logical Clocks, Message Delivery Rules, Concurrency, Atomic Actions, Consensus Protocols, Modeling Concurrency with Petri Nets, Client-Server Paradigm

### UNIT III

#### **Cloud Infrastructure**

Cloud Computing at Amazon, Google Perspective, Microsoft Windows Azure and Online Services, Open-Source Software Platforms for Private clouds, Intercloud, Responsibility Sharing Between User and Cloud service provider, Cloud Virtualization, Layering, Full Virtualization and Paravirtualization.

### UNIT IV

#### **Cloud Computing Services:**

Standard Cloud Model, Cloud Deployment Model, Service Delivery Models, Service Abstraction, SPI Model, Traditional System vs Cloud System Model, All Applications delivered using web services are not SaaS, SaaS and PaaS: Salesforce.com and Force.com, Open Cloud Services.

**Course Outcomes (COs):** By the completion of the course, the students are able to:

CO1: Identify the Parallel and Distributed computing technologies involved in Cloud.

CO2: Explain the design principles involved in building a Cloud platform over virtualized clusters and data centers

CO3: Analyze different performance metrics for evaluating Cloud Applications.

CO4: Prepare Cloud based applications that can scale out.

CO5: Apply task and data parallel distributed algorithms for Cloud.

#### **TEXT BOOKS**

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski: "Cloud Computing: Principles and Paradigms", Wiley, 2011
3. Nikos Antonopoulos, Lee Gillam: "Cloud Computing: Principles, Systems and Applications", Springer, 2012
4. Ronald L. Krutz, Russell Dean Vines: "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India, 2010
5. Tim Mather, Subra Kumara swamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Media, 2009

## DISTRIBUTED DATABASES

Semester	V				
Course cod					
Category	Professional Elective Course – I				
Course title	Distributed Databases				
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 educational Objectives of this Course are:

1. To Introduce various Distributed Database Applications in real world scenario
2. To be learning more about various Distributed Database Techniques
3. Applying efficient Advanced Techniques to solve engineering problems

### Course Outcomes

On successful completion of the course, the student will: Be able to Compare various Distributed Databases methods Be able to understand and identify the analytical characteristics of Distributed Databases algorithms. Employ algorithm to model engineering problems, when appropriate.

### UNIT I

**Introduction:** Distributed Data Processing Promises of DDBs Complicating Factors and Problem Areas.

**Architecture of distributed systems:** Architectural Models for Distributed DBMSs Homogeneous Heterogeneous Client/server Distributed Databases versus Replicated Databases

### UNIT II

**Distributed Database Design:** Alternative Design Strategies Distribution Design Issues Fragmentation Allocation.

**Concepts of Database links** Introduction Types Database Links Creating and Managing Database Links Restrictions through Database Links Practical Scenarios and examples

### UNIT III

**Transparencies:** Database link name resolution Schema object name resolution Location trans-RPC, creating location transparencies using views, synonyms and procedures

Transaction processing Concept and Properties of Transactions Remote and Distributed SQL Statements Shared SQL for Remote and Distributed Statements Remote and Distributed Transactions

### UNIT IV

**Semantic:** Data Control View Management Data Security Semantic Integrity control

**Query processing and Query optimization strategies:** Distributed Query Processing Methodology. Distributed Query Optimization. New query optimization techniques in distributed database. Distributed Query Optimization problems and some solutions. Advantages of query optimization techniques in distributed database.

- Text and REFERENCE BOOKS:**
1. Principles of Distributed Database Systems by M. TAMER OZSU, Patrick Valduriez, S. Sridhar (Pearson Publication)
  2. Database system concepts', 6th Edition –Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International )
  3. Distributed Databases by Stefano Ceri, Giuseppe Pelagatti(TMh)
  4. Oracle Documentation

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)  
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		Soft Computing	3	0	0	3	3	30	70		100	3
2.	PCC		Big Data Analysis	3	0	0	3	3	30	70		100	3
3.	PCC		Data Science using AI approach	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		Data Science using AI approach Lab	0	0	2	2	1	50		50	100	2
8.	LC		Soft Computing Lab	0	0	2	2	1	50		50	50	2
9.	LC		Big Data Analysis Lab	0	0	2	2	1	50		50	50	2
10.	PROJ		Project - I	0	0	2	2	1	50		50	100	3
			<b>Total</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>26</b>	<b>22</b>	<b>380</b>	<b>420</b>	<b>200</b>	<b>900</b>	

**NOTE:**

4. **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 etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.**
5. **Choose any one from Professional Elective Course – II**
6. **Choose any one from Professional Elective Course – III**
7. **Choose any one from Open Elective Course – II**
  - Professional Elective Course – II**
    1. Computer Graphics
    2. Cryptography and Security
    3. Pattern and Visual Recognition
    4. Internet of Things
    5. Advance Database Management System
  - Professional Elective Course – III**
    1. Advanced Java
    2. Compiler Design
    3. Speech Processing and Applications
    4. Software Engineering

## SOFT COMPUTING

Semester	VI			
Course code				
Category	Professional Elective Courses			
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 OBJECTIVES:

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 a 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 & Matlab:- Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition. Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

### COURSE OUTCOMES:

1. Identify and describe soft computing techniques and their roles in building intelligent Machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.

### 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 McGrawHill.
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.

## SOFT COMPUTING LAB

Semester	VI			
Course code				
Category	Professional Elective Courses			
Course title	Soft Computing lab			
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			

### COURSE OUTCOMES:

1. Analyze a problem, identify and define computing requirements, design and implement appropriate solutions
2. Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools
3. Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.
4. Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables
5. Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.

1. Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights
2. Write a program to implement artificial neural network without back propagation.
3. Write a program to implement artificial neural network with back propagation.
4. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
5. Implement travelling sales person problem (tsp) using genetic algorithms.
6. Implement linear regression and multi-regression for a set of data points.
7. Implement crisp partitions for real-life iris dataset.
8. Write a program to implement Hebb's rule Write a program to implement Delta rule.
9. Write a program to implement logic gates.
10. Implement svm classification by fuzzy concepts.

## BIG DATA ANALYSIS

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Big Data Analysis				
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. Explore the fundamental concepts of Big Data analysis
2. Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets)
3. Examine the distributed and parallel computing and its application for big data analysis
4. Analyse how to deal with huge amount of data and propose scalable solutions
5. Evaluate statistical packages and deriving intelligence from unstructured information
6. Compile and contrast among different big data analytics tools and how they can help solving Industry challenges

### **Unit I**

Introduction to Big Data, challenges of conventional systems, Evolution of analytic scalability , Modern data analytic tools

Modelling techniques: Mining frequent itemsets, Apriori algorithm, Handling large data sets in main memory ,Clustering techniques, clustering for parallelism, Classification and Prediction: Decision Tree induction, Developing models using Decision Tree Algorithms

### **Unit II**

Frameworks: Overview of Hadoop, Hadoop Distributed File System, HDFS design and architecture Hadoop Map reduce Framework, HBASE, Interacting HDFS using HIVE, sample programs in HIVE-PIG

### **Unit III**

Data Analysis and mining data streams: Regression modelling, Rule Induction Fuzzy decision trees and neural networks Introduction to streams concepts, Real time analytics platform, case studies

### **Unit IV**

Visualization: Visual data analysis techniques, Interaction techniques Analytics using statistical packages, association intelligence from unstructured information Text analytics, industry challenges and application of analytics

### **Course Outcomes**

1. Explore the fundamental concepts of Big Data analysis
2. Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets)
3. Examine the distributed and parallel computing and its application for big data analysis
4. Analyse how to deal with huge amount of data and propose scalable solutions
5. Evaluate statistical packages and deriving intelligence from unstructured information
6. Compile and contrast among different big data analytics tools and how they can help solving Industry challenges.

**Text and References:**

1. Bill Franks, "Taming the big data tidal wave: finding opportunities in huge data streams with advanced analytics", John Wiley & Sons, 2012
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer 2007
4. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008

## BIG DATA ANALYSIS LAB

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Big Data Analysis lab				
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				

**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.

**Text Books:** Tom White, "Hadoop: The Definitive Guide" Fourth Edition, O'Reilly Media, 2015.

Reference Books:

1. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007
2. Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets Cambridge University Press, 2012.

**Course Outcomes:** Upon completion of the course, the students should be able to:

1. Configure Hadoop and perform File Management Tasks (L2)
2. Apply MapReduce programs to real time issues like word count, weather dataset and sales of a company (L3)
3. Critically analyze huge data set using Hadoop distributed file systems and MapReduce (L5)
4. Apply different data processing tools like Pig, Hive and Spark.(L6)

## DATA SCIENCE USING AI APPROACH

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Data Science using AI approach				
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 impart the basic concepts of Python programming.
2. To understand concepts and usage of NumPy and Pandas package for numerical data calculations in Python.
3. To understand concepts and applications of various data visualization tools of Python on real world data.
4. To understand and implement the Machine Learning Concepts in Python.

#### Unit I

Overview of Python Programming Concepts: The concept of data types; variables, assignments; numerical types; operators and expressions; Control Structures; String manipulations; File Handling – creating, reading/writing text/number files; Dictionaries; Functions; OOPs Concepts

#### Unit II

Introduction to Numpy - Creation on Array ,Array generation from Uniform distribution, Random array generation, reshaping, maximum and minimum, reshaping, Arithmetic operations, Mathematical functions, Bracket Indexing and Selection, Broadcasting, Indexing a 2D array (matrices); Data Manipulation with Pandas -Creating a Series - from lists, arrays and dictionaries, Storing data in series from intrinsic sources, Creating Data Frames, Imputation, Grouping and aggregation, Merging, Joining, Concatenation, Find Null Values or Check for Null Values, Reading data from csv, txt, excel, web.

#### Unit III

Introduction to Visualization - Installing and setting up visualization libraries, Canvas and Axes, Subplots, Common plots – scatter, histogram, boxplot, Logarithmic scale, Placement of ticks and custom tick labels, Pandas Viz, Style Sheets, Plot type, Area, Barplots, Histograms, Line Plots, Scatter Plots, BoxPlots, Hexagonal Bin Plot, Kernel Density Estimation plot (KDE), Distribution Plots, Categorical Data Plots, Combining Categorical Plots, Matrix Plots, Regression Plots, Grids; Python Visualizations toolkits/libraries.

#### Unit IV

Introduction to Machine Learning with SciKit-Learn & PyTorch– Data Representation and basic functions Estimator, parameters & model validation, Model Selection, Curve, Grid search, Feature engineering, Naive Bayes Classification, Linear regression, SVM etc; Overview of other Python ML/Deep Learning toolkits/Libraries. Introduction to NLP with NLTK and its functions, modules like speech tagging, tokenization, parsing, segmentation, recognition, cleaning & normalization of text etc; Overview of other

Python NLP toolkits/Libraries.

**COURSE OUTCOMES:**

1. Understand and implement the basics of programming in Python.
2. Apply the Numpy package for numerical calculations in Python.
3. Apply Pandas package for loading and preprocessing data in Python. Implement various data visualization tools of Python on real world data.
4. Understand and implement the Machine Learning Concepts in Python.

**TEXTBOOKS:**

1. Charles Dierbach., Introduction to Python using Computer Science, Wiley Publications, Second Edition, 2015
2. Mark Lutz , Learning Python, O'Reilly publications , Fifth Edition, 2015
3. Jake Vander Plas, Python Data Science Handbook, O'Reilly , 2016
4. Paul Barry, Head First Python, Orielly Publications, Second Edition, 2010

## **DATA SCIENCE USING AI APPROACH LAB**

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Data Science using AI approach lab				
Scheme and Credits	L	T	P	Cre dits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

### **Tentative List of Experiments:**

1. Python program to display details about the operating system, working directory, files And directories in the current directory, lists the files and all directories, scan and classify them as directories and files
2. Python program to convert an array to an array of machine values and vice versa
3. Python program to get information about the file pertaining to the file mode and to get time values with components using local time and gm time.
4. Python program to connect to Google using socket programming
5. Python program to perform Array operations using Numpy package
6. Python program to perform Data Manipulation operations using Pandas package.
7. Python program to display multiple types of charts using Matplotlib package
8. Python program to perform File Operation on Excel Data Set
9. Python program to implement with Python Sci Kit-Learn & NLTK.
10. Python program to implement with Python NLTK/Spicy/Py NLPI.

**PROFESSIONAL  
ELECTIVE COURSE –  
II**

# COMPUTER GRAPHICS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Computer Graphics				
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 list the basics concepts used in computer graphics.
2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, area filling, clipping.
3. To describe the importance of viewing and projections.
4. To design an application with the principles of virtual reality and understand a typical image processing.

### **Unit I**

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, Two dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's; Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, mid-point circle drawing algorithm; Filled area algorithms: Scanline: Polygon filling algorithm, boundary filled algorithm.

### **Unit II**

Two/Three Dimensional Viewing: The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms):- 4 bit code algorithm, Sutherland-cohen algorithm, parametric line clipping algorithm (Cyrus Beck).

Polygon clipping algorithm: Sutherland-Hodgeman polygon clipping algorithm. Two-dimensional transformations: transformations, translation, scaling, rotation, reflection, composite transformation.

Three-dimensional transformations: Three-dimensional graphics concept, Matrix representation of 3-D Transformations, Composition of 3-D transformation.

### **Unit III**

Viewing in 3D: Projections, types of projections, the mathematics of planner geometric projections, coordinate systems.

Hidden surface removal: Introduction to hidden surface removal Z- buffer algorithm, scanline algorithm, area sub-division algorithm.

### **Unit IV**

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.

Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency. What is an image? Filtering, image processing, geometric transformation of images.

## **COURSE OUTCOMES:**

1. Understand the basics concepts used in computer graphics.
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, area

filling, clipping.

3. Understand the importance of viewing and projections.

4. Design an application with the principles of virtual reality and understand a typical image processing.

**TEXT/REFERENCE BOOKS:**

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.

2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2nd Edition, 1999, PHI.

3. Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition

4. Fundamentals of 3Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.

5. Computer Graphics: Secrets and Solutions by Corrign John, BPB

6. Graphics, GUI, Games & Multimedia Projects in C by Pilania & Mahendra, Standard Publ.

7. Computer Graphics Secrets and solutions by Corrign John, 1994, BPV

8. Introduction to Computer Graphics By N. Krishanmurthy T.M.H 2002

## CRYPTOGRAPHY AND SECURITY

Semester	VI				
Course code					
Category	Professional Elective 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.

### **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.

### **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 (2<sup>n</sup>) 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.

#### **TEXT AND REFERENCE BOOKS:**

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

## Pattern and Visual Recognition

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Pattern and Visual Recognition				
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:

To help students understand basic mathematical and statistical techniques commonly used in pattern recognition. To introduce students to a variety of pattern recognition algorithms.

### Unit I

#### Introduction and mathematical Preliminaries

Principles of pattern recognition: Uses, mathematics, Classification and Bayesian rules, Clustering vs classification, Basics of linear algebra and vector spaces, Eigen values and eigen vectors, Rank of matrix and SVD

### Unit II

#### Pattern Recognition basics

Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Parameter estimation methods, Hidden Markov models, dimension reduction methods, Fisher discriminant analysis, Principal component analysis, non-parametric techniques for density estimation, non-metric methods for pattern classification, unsupervised learning, algorithms for clustering: K-means, Hierarchical and other methods

### Unit III

#### Feature Selection and extraction

Problem statement and uses, Branch and bound algorithm, Sequential forward and backward selection, Cauchy Schwartz inequality, Feature selection criteria function: Probabilistic separability based and Interclass distance based, Feature Extraction: principles

#### Visual Recognition

Human visual recognition system, Recognition methods: Low-level modelling (e.g. features), Mid-level abstraction (e.g. segmentation), High-level reasoning (e.g. scene understanding); Detection/Segmentation methods; Context and scenes, Importance and saliency, Large-scale search and recognition, Egocentric vision, systems, Human-in-the-loop interactive systems, 3D scene understanding.

## Unit IV

### Recent advancements in Pattern Recognition

Comparison between performance of classifiers, Basics of statistics, covariance and their properties, Data condensation, feature clustering, Data visualization, Probability density estimation, Visualization and Aggregation, FCM and soft-computing techniques, Examples of real-life datasets.

### TEXT BOOKS/SUGGESTED REFERENCES:

1. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer, 2006.
2. Pattern Classification by Richard O. Duda , Peter E. Hart, David G. Stork, Wiley, 1973.
3. <https://nptel.ac.in/courses/106/106/106106046/>

### COURSE OUTCOMES:

After completion of course, students would be able to:

1. Understand basic mathematical and statistical techniques commonly used in pattern recognition.
2. Apply a variety of pattern recognition algorithms.
3. Understand and apply various pre-processing algorithms.
4. Apply various algorithms for image classification

# INTERNET OF THINGS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	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. 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 I

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 II

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

### Unit III

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 IV

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

## COURSE OUTCOMES:

1. Understand the concepts of Internet of Things
2. Analyze basic protocols network
3. Understand the concepts of Web of Things
4. Design IoT applications in different domain and be able to analyze their performance

## TEXT/REFERENCE BOOKS:

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Walteneagus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

# ADVANCED DATABASE MANAGEMENT SYSTEM

Semester	VI			
Course code				
Category	Professional Elective Courses			
Course title	<b>Advanced Database Management System</b>			
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 DBMS Components, Advantages and Disadvantages.
2. Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

## UNIT I

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra, SQL, Normal forms. Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

## UNIT II

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery. Concurrency: Introduction, Serializability, Concurrency control, Locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multiversion techniques, Deadlocks.

## UNIT III

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment. Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

## UNIT IV

Object Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

## COURSE OUTCOMES:

1. Students will get understanding of DBMS Components, Its advantages and disadvantages.

2. Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

**TEXT AND REFERENCE BOOKS:**

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education, 2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998  
Suggested
4. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
5. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
6. Silberschatz, Korth, Sudarshan, "Database System Concepts", McGraw Hill, 6th Edition, 2006
7. W. Kim, "Modern Database Systems", 1995, ACM Press, Addison Wesley

**PROFESSIONAL  
ELECTIVE COURSE –  
III**

# ADVANCED JAVA

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Advanced 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 OBJECTIVES:

1. To study the fundamental concepts of programming in Java including the designing of interactive applications.
2. To learn the concepts of connecting with databases.
3. To gain the insights of servlet concept.
4. To understand the fundamental concepts of JSP.

### UNIT I

Introduction: Concepts of Classes and Objects, Constructors, Inheritance, Function Overloading, Polymorphism, Packages and Interfaces, exception handling, file streams and their manipulation. AWT & Applet Programming Design of User Interfaces: Swing, Japplet, Icons and Labels, Text Fields, Buttons, Jbutton Class, Check Box, Radio Buttons, The Container, Panel, Windows, and Frame Classes, Combo Box, Tabbed Panes, Scroll Panes, Trees, Tables, Custom Rendering of Jlist Cells.

### UNIT II

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL statements, working with Result Set Object & Result Set Meta Data. Java Beans: Java Bean, Installing, Starting Bean Development Kit, Use of JAR files and the use of Java Beans API.

### UNIT III

Servlets: Introduction to Servlets, Life cycle of Servlets, Creating, Compiling and running servlet, Reading the servlet Parameters, Reading Initialization parameter, Packages- javax.servletPackage, Handling HTTP Request and Response (GET / POST Request), Cookies and Session Tracking.

### UNIT-IV

JSP: JSP Architecture, JSP Access Mode, JSP Syntax Basic (Directions, Declarations, Expression, Scriplets and Comments, JSP Implicit Object, Object Scope, Synchronization Issue, Session Management.

## COURSE OUTCOMES:

1. Have an ability to apply the core Java concepts for designing applications.
2. Have an ability to use the Java concepts for accessing a database.
3. Have an ability to understand the utility of server side technologies.
4. Have basic understanding and knowledge of JSP.

## TEXT/REFERENCE BOOKS:

1. Gary Cornell and Horstmann Cay S., Core Java, Vol I and Vol II, Sun Microsystems Press.

2. Herbert Schildt, Java: The Complete Reference, McGraw-Hill.
3. Philip Hanna, JSP: The Complete Reference, McGraw-Hill.
4. Deital and Deital, Java How to Program, Prentice Hall (2007).

## COMPILER DESIGN

Semester	VI			
Course cod				
Category	Professional Core Courses			
Course title	Compiler 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			

### COURSE OBJECTIVES:

1. To teach concepts of language translation and phases of compiler design
2. To describe the common forms of parsers
3. To inculcate knowledge of parser by parsing LL parser and LR parser
4. To demonstrate intermediate code using technique of syntax directed translation
5. To Illustrate the various optimization techniques for designing various optimizing compilers

#### UNIT I

Introduction to Compiling: Compilers, Analysis of the source program, The phases of a compiler, Cousins of the compiler, The grouping of phases, Compiler-construction tools A Simple One-Pass Compiler: Overview, Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines, Putting the techniques together Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language for specifying lexical analyzers, Finite automata, From a regular expression to an NFA, Design of a lexical analyzer generator, Optimization of DFA-based pattern matchers

#### UNIT II

Syntax Analysis: The role of the parser, Context-free grammars, Writing a grammar, Top-down parsing, Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators Syntax-Directed Translation: Syntax-directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes, Recursive evaluators, Space for attribute values at compile time, Assigning space at compile time, Analysis of syntax-directed definitions

#### UNIT III

Type Checking: Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators, Polymorphic functions, An algorithm for unification Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques, Storage allocation in Fortran.

#### UNIT IV

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions, Case statements, Back Patching, Procedure calls Code generation: Issues in the design of a code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, Next-use information, A Simple code generator, Register allocation and assignment, The dag representation of basic blocks, Peephole optimization, Generating code from dags, Dynamic programming code-generation algorithm, Code-generator generators Code Optimization: Introduction, The Principal sources of optimization, Optimization of basic blocks, Loops in flow graphs, Introduction to global data-flow analysis, Iterative solution of data-flow equations, Codeimproving transformations, Dealing with aliases, Data-flow analysis of structured flow graphs, Efficient data-flow algorithms, A tool for data-flow analysis,

Estimation of types, Symbolic debugging of optimized code.

## **COURSE OUTCOMES**

CO 1: Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers. K3, K6

CO 2: Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table. K2, K6

CO 3: Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes. K4, K5

CO 4: Acquire knowledge about run time data structure like symbol table organization and different techniques used in that. K2, K3

CO 5: Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization. K2, K4

### **Text Books:**

1. Compilers Principles, Techniques, & Tools, by A.V.Aho, R.Sethi & J.D.Ullman, Pearson Education
2. Principle of Compiler Design, A.V.Aho and J.D. Ullman, Addison – Wesley of CSE - 2

# Speech Processing and Applications

Semester	VI				
Course code					
Category					
Course title	Speech Processing and Applications				
Scheme and Credits	L	T	P	Cred its	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 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 Outcomes (COs):

1. To learn the basics of speech processing.
2. To be able to understand the various stages of processing a speech signal.
3. To be able to analyse, synthesize and apply the techniques of speech recognition and speaker verification.

### UNIT I

#### NATURE OF SPEECH SIGNAL

Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.

### UNIT II

#### TIME DOMAIN METHODS FOR SPEECH PROCESSING

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation. Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

### UNIT III

#### FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation,

Implementation issues.

#### **UNIT IV: LINEAR PREDICTIVE CODING OF SPEECH**

Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.

#### **HOMOMORPHIC SPEECH ANALYSIS**

Central analysis of speech, formant and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.

#### **TEXTBOOKS:**

2. L.R. Rabiner and R.E Schafer: Digital processing of speech signals, Prentice Hall, 1978.
3. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.

# SOFTWARE ENGINEERING

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Software engineering				
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. Fundamental knowledge of software engineering
2. To make student aware of best software engineering practices
3. Inculcate ability in students to work as an effective member or leader of software engineering teams
4. To help students to develop skills that will enable them to construct software of high quality

### **Unit I**

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.

Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking.

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

### **Unit II**

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling; Design Heuristics for effective modularity; the design model; Design documentation. Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements Into software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

### **Unit III**

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing:

Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering

#### **Unit IV**

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management.

Computer aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

#### **COURSE OUTCOMES:**

1. Illustrate and compare an effective software engineering process, based on knowledge of widely used development lifecycle model
- 2: Apply effective requirement elicitation techniques to develop SRS for a project.
- 3: Construct design documents with the help of designing tools
- 4: Analyze testing strategies for a software system
- 5: Develop and deliver quality software as an individual or as part of a multidisciplinary team.
- 6: Adapt techniques and tools necessary for software engineering practices.

#### **TEXT AND REFERENCES:**

1. Software Engineering – A Practitioner’s Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering, Rajib Mall, PHI
3. Software Engineering by Ian Sommerville, Pearson Edu, 5<sup>th</sup> edition, 1999, AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995 JW&S,
6. An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa,
7. Gill, Nasib Singh: Software Engineering, Khanna Book Publishing Company(Private) Limited, New Delhi.

**B. Tech. (Computer Science and Engineering- Artificial Intelligence)**  
**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.	PCC		Cognitive computing	3	0	0	3	3	30	70		100	3
2.	PEC		Professional Elective Course - IV	3	0	0	3	3	30	70		100	3
4.	OEC		Open Elective Course - III	3	0	0	3	3	30	70		100	3
5.	OEC		Open Elective Course - IV	3	0	0	3	3	30	70		100	3
6.	LC		Cognitive computing Lab	0	0	2	2	1	50		50	100	2
7.	HSMC		Organizational Behavior	3	0	0	3	3	30	70		100	3
8.	PROJECT		Project - II	0	0	8	8	4	100		100	200	3
9.	Training		Practical Training-2	0	0	2	2	1	50		50	100	3
			<b>Total</b>	<b>15</b>	<b>0</b>	<b>12</b>	<b>27</b>	<b>21</b>	<b>350</b>	<b>350</b>	<b>200</b>	<b>900</b>	

NOTE:

1. Choose any one from Professional Elective Course – IV
2. Choose any one from Open Elective Course – III & IV

**Professional Elective Course – IV**

1. Cyber Security Threats
2. Web Mining
3. Digital Image Processing
4. Deep and Reinforcement Learning
5. Information Security and Data Hiding

# COGNITIVE COMPUTING

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Cognitive Computing				
Scheme and Credits	L	T	P	Cre dits	
	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. Use the Innovation Canvas to justify potentially successful products.
2. Explain various ways in which to develop a product idea.

### Unit I

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services

### Unit II

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

### Unit III

Relationship between Big Data and Cognitive Computing : Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics

### Unit IV

The Business Implications of Cognitive Computing : Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive

platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

**COURSE OUTCOMES:**

1. Understand applications in Cognitive Computing.
2. Understand Natural language processor role in Cognitive computing .
3. Learn future directions of Cognitive Computing.
4. Evaluate the process of taking a product to market

## **COGNITIVE COMPUTING LAB**

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Cognitive Computing Lab				
Scheme and Credits	L	T	P	Cre dits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### **List of Experiments:**

1. Implement Long Term Memory encoding approach.
2. Implement Models of semantic memory.
3. Implement Brain Signals and Feature extraction.
4. Implement Neuroscientific Model. Psychological Model.
5. Implement Representational Model. Multiple realizable Model.
6. Implement Isomorphic Model. Multiple Draft Model.
7. Implement Decision Making models.
8. Implement Machine Learning algorithms for cognitive computing.
9. Implement Data Mining algorithms for cognitive computing.
10. Implement Neural Networks algorithms for cognitive computing.

**PROFESSIONAL  
ELECTIVE COURSE –  
IV**

## CYBER SECURITY THREATS

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	<b>Cyber Security Threats</b>				
Scheme and Credits	L	T	P	Cre dits	
	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 learner will gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.
2. The learner will understand key terms and concepts in cyber law, intellectual property and cybercrimes, trademarks and domain theft.
3. The learner will be able to examine secure software development practices.
4. The learner will understand principles of web security.
5. The learner will be able to incorporate approaches for risk management and best practices.
6. The learner will gain an understanding of cryptography, how it has evolved, and some key encryption techniques used today.
7. The learner will develop an understanding of security policies (such as confidentiality, integrity, and availability), as well as protocols to implement such policies.

#### **UNIT I**

Introduction: Security threats - Sources of security threats- Motives - Target Assets and vulnerabilities – Consequences of threats- E-mail threats - Web-threats - Intruders and Hackers, Insider threats, Cyber crimes. Network Threats: Active/ Passive – Interference – Interception – Impersonation – Worms –Virus – Spam’s – Ad ware - Spy ware – Trojans and covert channels –Backdoors – Bots – IP, Spoofing - ARP spoofing - Session Hijacking - Sabotage-Internal treats Environmental threats - Threats to Server security

#### **UNIT II**

Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation –Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools –Threat identification - Threat Analysis - Threat Modelling - Model for Information Security Planning.

#### **UNIT III**

Security Elements: Authorization and Authentication - types, policies and techniques – Security certification - Security monitoring and Auditing - Security Requirements Specifications – Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots

#### **UNIT IV**

Access control, Trusted Computing and multilevel security - Security models, Trusted Systems, Software security issues, Physical and infrastructure security, Human factors – Security awareness, training, Email and Internet use policies.

**COURSE OUTCOMES:**

1. Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
2. Design, develop, test and evaluate secure software.
3. Develop policies and procedures to manage enterprise security risks.
4. Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.
5. Interpret and forensically investigate security incidents.

**REFERENCE BOOKS:**

1. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
2. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.
3. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005
4. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.

## WEB MINING

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Web Mining				
Scheme and Credits	L	T	P	Cre dits	
	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 architecture of web, mining the data, issues, challenges.
2. To study the methods of extracting knowledge from web data, text and unusual data.
3. To understand and use data mining language like R, Python etc.
4. To understand the optimization of web and its applications.

#### Unit I

Data Mining Foundations: Basic concepts in data Mining, Web mining versus Data mining, Discovering knowledge from Hypertext data; An overview of web mining : What is Web mining, Web mining taxonomy, Web mining subtasks, issues, challenges

#### Unit II

Web Search and Information Retrieval : Information Retrieval Models, Web Search and IR, Text Mining, , Latent Semantic Indexing, Web Spamming, Clustering and Classification of Web Pages, Information Extraction , Web Content Mining;

#### Unit III

Optimization : Introduction to Models and Concept of Computational Intelligence, Social Behavior as Optimization: Discrete and Continuous Optimization Problems, Classification of Optimization Algorithms, Evolutionary Computation Theory and Paradigm, Swarm and Collective intelligence

#### Unit IV

Swarm Intelligence Techniques: Particle Swarm Optimization, Ant Colony Optimization, Artificial Bees and Firefly Algorithm etc., Hybridization and Comparisons of Swarm Techniques, Application of Swarm Techniques in Different Domains and Real World Problems

### COURSE OUTCOMES:

power of web search engine by classifying the web documents and identifying the web pages

1. Learn how the Web mining helps to improve the power of web search engine by classifying the web documents and identifying the web pages.
2. How to predict user behaviour in the web.
3. For a given data set how the optimization will be performed.

### TEXT BOOKS/REFERENCE BOOKS:

1. Witton Frank, Data Mining , Morgan Kauffman Publishers.
2. Kennedy, J. and Eberhart, R.C., Swarm Intelligence, Morgan Kaufmann Publishers, 2001
3. Bonabeau, E., Dorigo, M. and Theraulaz, G., Swarm Intelligence: From Natural to Artificial Systems, Oxford University Press, 1999
4. Dorigo, M., Stutzle, T., Ant Colony Optimization, MIT Press, 2004
5. Parsopoulos, K.E., Vrahatis, M.N., Particle Swarm Optimization and Intelligence: Advances and Applications, Information Science Reference, IGI Global, 2010
6. Clerc, M., ParticleSwarm Optimization, ISTE, 2006
7. Nature Inspired Metaheuristic Algorithms, Xin-She Yang, Luniver Press, 2010

## DIGITAL IMAGE PROCESSING

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Information Hiding Techniques				
Scheme and Credits	L	T	P	Cre dits	
	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 become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

### **COURSE OUTCOMES:**

**At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

## **Unit I**

### **Fundamentals**

Need for DIP- Fundamental steps in DIP – Elements of visual perception -Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization.

## **Unit II**

### **Image Transforms**

Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT, Discrete cosine transform and KL transform.-Discrete Short time Fourier Transform- Wavelet Transform- Discrete wavelet Transform- and its application in Compression.

Image Enhancement

### Unit III

**Spatial Domain:** Basic relationship between pixels- Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. Frequency Domain: Smoothing frequency domain filters- sharpening frequency domain filters Homomorphic filtering.

**Image Restoration:**

Overview of Degradation models –Unconstrained and constrained restorations-Inverse Filtering ,WienerFilter.

### Unit IV

**Feature Extraction:**

**Detection of discontinuities** – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation- matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology – Boundary descriptors- Regional descriptors.

Text Book

1. Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education- 2/e – 2004.
2. Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education-2003.

Reference Books:

1. B.Chanda & D.Dutta Majumder – Digital Image Processing and Analysis – Prentice Hall of India – 2002
2. William K. Pratt – Digital Image Processing – John Wiley & Sons-2/e, 2004

# DEEP AND REINFORCEMENT LEARNING

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Deep and Reinforcement Learning				
Scheme and Credits	L	T	P	Cre dits	
	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 OUTCOMES:

After completing the course student should be able to:

1. Describe in-depth about theories, models and algorithms in machine learning.
2. Compare and contrast different learning algorithms with parameters.
3. Examine the nature of a problem at hand and find the appropriate learning algorithms and it's parameters that can solve it efficiently enough.
4. Design and implement of deep and reinforcement learning approaches for solving real-life problems.

## Unit I

History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Activation functions, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalue Decomposition. Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention overimages.

## Unit II

Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Batch Normalization, Instance Normalization, Group Normalization.

Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Learning Vectorial Representations Of Words, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Recent Trends in Deep Learning Architectures.

## Unit III

Introduction to reinforcement learning(RL), Bandit algorithms – UCB, PAC, Median Elimination, Policy Gradient, Full RL & MDPs, Bellman Optimality, Dynamic Programming - Value iteration, Policy iteration, and Q-learning & Temporal Difference Methods, Temporal-Difference Learning,

Eligibility Traces, Function Approximation, Least Squares Methods

#### **Unit IV**

Fitted Q, Deep Q-Learning , Advanced Q-learning algorithms , Learning policies by imitating optimal controllers , DQN & Policy Gradient, Policy Gradient Algorithms for Full RL, Hierarchical RL,POMDPs, Actor-Critic Method, Inverse reinforcement learning, Maximum Entropy Deep Inverse Reinforcement Learning, Generative Adversarial Imitation Learning,Recent Trends in RL Architectures.

#### **TEXT BOOKS:**

1. Deep Learning, An MIT Press book, Ian Goodfellow and YoshuaBengio and Aaron Courville
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
3. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.
4. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds

# INFORMATION SECURITY AND DATA HIDING

Semester	VI			
Course code				
Category	Professional Elective Courses			
Course title	Information security and data hiding			
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 about data hiding applications and their techniques.
2. To learn about hacking.
3. To learn security based protocols, attacks and intrusions.
4. To work with advance data hiding techniques.

### UNIT I

Introduction: - The need for security, security approach, principles of security, types of attack, denial of service, IP spoofing, Phishing. Digital signature, Firewall.

### UNIT II

Hacking:- Basics, Email hacking, computer hacking, types of hacking, practice against hacking, Access Authorization, Compression, LZW Compression and Decompression Method.

### UNIT III

Data hiding:- Terms related to data hiding, Differences between cryptography, stenography & watermarking, history of stenography. Applications of data hiding.

### UNIT IV

Advance data hiding techniques :- Transform domain, difference between special domains and transform domain, wavelets, advantages of wavelet, and wavelet based techniques for data hidings.

## COURSE OUTCOMES:

1. Explain information security.
2. Give an overview of access control of relational databases.
3. State the basic concept in information systems security, including security technology and principles, software security and trusted systems and IT security management.
4. Learn advance data hiding techniques.

## TEXT REFERENCE BOOKS:

1. Cryptography and Network Security by Atul Khat e, Mc Graw Hill Publisher
2. E-mail Hacking by Ankit Fadia, Vikash Publishers
3. Data communication and Networking , Behrouz A. Forouzan .

## ORGANISATIONAL BEHAVIOUR

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Organisational Behaviour				
Scheme and Credits	L	T	P	Cre dits	
	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.

### Unit I

**Learning objectives:** Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager

**Learning:** Nature of learning, How learning occurs, Learning & OB

### Unit II

**PERSONALITY:** Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB

**PERCEPTION:** Meaning & Definition, Perceptual process, Importance of Perception in OB  
**MOTIVATION:** Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory

### Unit III

**COMMUNICATION:** Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness  
**GROUPS IN ORGANISATION:** Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building

**LEADERSHIP:** Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader  
**CONFLICT:** Nature of Conflict & Conflict Resolution  
**TRANSACTIONAL ANALYSIS:** An Introduction to Transactional Analysis

### Unit IV

**ORGANISATIONAL CULTURE:** Meaning & Definition, Culture & Organisational Effectiveness  
**HUMAN RESOURCE MANAGEMENT:** Introduction to HRM, Selection, Orientation, Training & Development, Performance Appraisal, Incentives

**ORGANISATIONAL CHANGE:** Importance of Change, Planned Change & OB Techniques

**INTERNATIONAL OB:** An Introduction to Individual & Interpersonal Behaviour in Global Perspectives

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**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.	PROJ		Project – III / Industrial Project	0	0	16	16	8	150		150	300	3
			Total	6	0	16	22	14	150	-	150	500	

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

# 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

- 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.
- The three minor examinations together must cover all the levels of COs.
- It is compulsory to give two assignments during the semester pertaining to the last three levels of COs.
- The sessional/minor examination answer sheet must be evaluated as per the COs.
- All the teachers are required to maintain the internal evaluation record according the COs
- All the teachers are required to submit the internal evaluation record along with the computation of attainment levels of COs.
- 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.
- 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).

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**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 of 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.

<b>Sample Overall Attainment Level of COs for Data Structures and Algorithms Course</b>	
<b>List of Course Outcomes</b>	<b>Level of attainment</b>
CO1. list or describe types of data structures and operations that can be implemented on these data structures.	<b>3</b>
CO2. Demonstrate the use of various data structure and their related operations	<b>3</b>
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.	<b>3</b>
CO4. Analyse the time complexity of searching and algorithms.	<b>2</b>
CO5. formulate data structures and prescribe operations for given real world situations.	<b>1</b>

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)

<b>Assessment Tools for Lab. Courses</b>		
<b>Direct Tools</b>		
<b>Sr No.</b>	<b>Description of the tool</b>	<b>COs Covered</b>
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)
<b>Indirect Tools</b>		
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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**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							
<b>Name of the Programme:</b> _____						Credits:	
<b>Semester:</b> _____						Total Marks: 100	
<b>Session:</b> _____							
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.

<b>S. No</b>	<b>Content</b>	<b>Tentative No. of pages</b>
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  
(Artificial Intelligence)**

(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.



# Gurugram University Gurugram

<b>Department of Computer Science and Engineering</b> <b>Gurugram University, Gurugram-</b> <b>122018</b>								
Name of the Programme: <hr/> Semester: <hr/> Session: <hr/>					Credits:  Total Marks: 100			
<b>Evaluation of Industrial Training/Internship Report (Code)</b>								
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:			



# Gurugram University Gurugram