

# **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)**

**FOR**

**BACHELOR OF TECHNOLOGY (B.Tech.)**

**(4 Year Undergraduate Degree Programme)**

**IN**

**COMPUTER SCIENCE AND ENGINEERING**

**(In alignment with National Education Policy, 2020)**

**[w. e. f. 2025-2026]**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**SRM UNIVERSITY DELHI-NCR, SONEPAT**

**39, Rajiv Gandhi Education City, Sonapat  
Haryana-131029**



## ENGINEERING GRADUATES EMPLOYABILITY ATTRIBUTES

Sound Knowledge and Skills of Basic Sciences & Engineering Sciences	An Engineer should be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
Problem Formulation, Analysis & Solving	An Engineer should be able to identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.
Design and Development of a Solution	An Engineer must be able to 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.
Investigation	An Engineer should 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.
Modern Tools Usage	An Engineer should be able to 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.
The Engineer and the Society	An Engineer should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
Environment and Sustainability	An Engineer must understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics	An Engineer should be able to apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
Individual and Teamwork	An Engineer should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Effective Communication	An Engineer should be able to 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.
Project Management and Finance	An Engineer must demonstrate knowledge and understanding of the engineering and management principles and apply these to the Engineering work environment, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Lifelong Learning	An Engineer must 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.

**SRM UNIVERSITY DELHI-NCR, SONEPAT**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (FEPEOs)**

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

**FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (FEPLOs)**

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences.
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. An ability to adapt and work with multidisciplinary teams and communicate effectively;
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. An understanding of professional and ethical responsibility;
7. An ability to acquire and apply new knowledge using appropriate learning strategies with an inner quest to learn, unlearn and relearn.

**MAPPING OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES  
AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES**

<b>FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES</b>	<b>FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES</b>
Advancement to a professional position by virtue of their knowledge, skills and attitude.	<ol style="list-style-type: none"> <li>1. An ability to identify, formulate, and solve real time engineering and socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences</li> <li>2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.</li> </ol>
Recognition for solving engineering problems and developing design solutions that consider safety and sustainability	<ol style="list-style-type: none"> <li>3. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.</li> <li>4. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health &amp; safety and sustainability</li> </ol>
Work as successful professionals in diverse engineering disciplines	<ol style="list-style-type: none"> <li>5. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health &amp; safety and sustainability</li> <li>6. An ability to adapt and work with multidisciplinary teams and communicate effectively;</li> </ol>
Increasing responsibilities of technical and managerial leadership in their work organizations;	<ol style="list-style-type: none"> <li>7. An ability to adapt and work with multidisciplinary teams and communicate effectively;</li> <li>8. An ability to function effectively on a team whose members together provide leadership, to create a</li> </ol>

	collaborative environment, to establish goals and to execute plan tasks.
Professional development through a commitment to career-long learning.	<ol style="list-style-type: none"><li>9. An understanding of professional and ethical responsibility;</li><li>10. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.</li></ol>

**MAPPING MATRIX OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES  
AND ENGINEERING PROGRAM LEARNING OUTCOMES**

**(TABULAR FORMAT)**

<b>MAPPING</b>	<b>FEPELO1</b>	<b>FEPELO2</b>	<b>FEPELO3</b>	<b>FEPELO4</b>	<b>FEPELO5</b>	<b>FEPELO6</b>	<b>FEPELO7</b>
<b>FEPEO1</b>	√	√					
<b>FEPEO2</b>		√	√				
<b>FEPEO3</b>			√	√			
<b>FEPEO4</b>				√	√	√	
<b>FEPEO5</b>						√	√

## **B.TECH - COMPUTER SCIENCE AND ENGINEERING GRADUATES EMPLOYABILITY ATTRIBUTES**

**EA 1: Sound Knowledge & Skill of Domain Area:** Ability to demonstrate problems related with mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program

**EA 2: Problem solving skills:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

**EA 3: Cognitive and Analytical skills:** Cognitive & Analytical skills help engineering graduates interpret data, remember team goals. These skills help them recall previous information that may relate to their organization's goals and help them make important connections between old and new information so that they can work more effectively.

**EA 4: Design Thinking:** An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.

**EA 5: Transferrable Skills:** Transferable skills are skills and abilities that are relevant and helpful across different areas of life: socially & professionally.

- **Interpersonal skills to work in diverse groups:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
- **Communication Skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such abilities include reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
- **Positive attitude and thinking:** An ability to have a positive attitude and thinking in challenging situations.
- **Adaptability:** Adapts learning strategies to new conditions. Recognizes parallels, analogies or similarities of new situations to more familiar situations.

- **Learn to Learn:** Learn ~~Unlearn~~ ~~Relearn~~: An ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.

**EA6: Information technology skills:** An ability to create, select, adapt, and extend appropriate techniques, resources, and modern ICT tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

**EA7: Sustainable Consumption and Production:** the demands for system upgrades (domestic and commercial) as well as the move to continuous provision of service (e.g. domestic devices that are always powered and available) needs to be balanced with the views of sustainable consumption and production. Server based solutions – such as Google Docs (Google Docs, 2009) – can be considered as one way of addressing such concerns where individuals need not upgrade their own machines as regularly and install local applications (with subsequent updates).

## **B.TECH - COMPUTER SCIENCE AND ENGINEERING PROGRAMME EDUCATIONAL OBJECTIVES**

**PEO1.** To nurture strong understanding in logical, mathematical and analytical reasoning among students coupled with a problem solving attitude that prepares them to productively engage in research and higher learning.

**PEO2.** To build a strong foundation in the field of Computer Science and Engineering among students to be creative and innovative.

**PEO3.** To prepare students capable of designing and developing real-world computing applications with high societal influence and impact.

**PEO4.** To provide students with an academic environment that enables them to understand the significance of life-long learning in varied situations and teams in a global perspective.

**PEO5.** To inculcate ethical practices, professionalism and environmental awareness for sustainable development among students enabling them for prospective employment in their chosen line of profession globally.

**PEO6.** To instill communication and management skills that generate entrepreneurship and / or leadership qualities.

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### PROGRAMME LEARNING OUTCOMES (PLOs)

**PLO1-Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and IC design and technology concepts towards modelling and prototyping Integrated systems.

**PLO2-Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PLO3-Design/development of solutions:** Design methodology to offer hardware solutions to public health, safety and agriculture, consumer electronics along with cultural, societal, and environmental considerations.

**PLO4-Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PLO5-Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**PLO6-The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PLO7-Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PLO8-Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PLO9-Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

**PLO10-Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PLO11-Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply the set one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PLO12-Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## UNITED NATIONS 17 SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The United Nations Sustainable Development Summit for the adoption of 2030 Agenda and the sustainable development goals was held during three historic days in New York, 25-27 September 2015.

Born out of the Rio+20 Conference through paragraph 283 of the Future We Want outcome document, the platform has been revitalized in preparation for the 2030 Agenda, with the 17 sustainable development goals\* at its core.

SDG-1: End poverty in all its forms everywhere

SDG-2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG-3: Ensure healthy lives and promote well-being for all at all ages

SDG-4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG-5: Achieve gender equality and empower all women and girls

SDG-6: Ensure availability and sustainable management of water and sanitation for all

SDG-7: Ensure access to affordable, reliable, sustainable and modern energy for all

SDG-8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG-9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG-10: Reduce inequality within and among countries

SDG-11: Make cities and human settlements inclusive, safe, resilient and sustainable

SDG-12: Ensure sustainable consumption and production patterns

SDG-13: Take urgent action to combat climate change and its impacts

SDG-14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

SDG-15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

SDG-16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG-17: Strengthen the means of implementation and revitalize the global partnership for sustainable development

\* <https://sdgs.un.org/publications/17-sustainable-development-goals-17-partnerships-17979>

**MAPPING MATRIX OF PROGRAM EDUCATIONAL OBJECTIVES (PEO's) AND  
PROGRAM LEARNING OUTCOMES (PLO's)**

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 0	PLO1 1	PLO1 2
PEO 1	√	√										
PEO 2			√	√								
PEO 3					√	√						
PEO 4							√	√				
PEO 5									√			
PEO 6										√	√	√

## **B.TECH COMPUTER SCIENCE AND ENGINEERING PROGRAMME STRUCTURE**

The Computer Science and Engineering curriculum is geared towards providing the student with a strong foundation in the discipline and the tools and competence to address new and challenging problems that they have not seen before. In order to earn a B. Tech. degree in Computer Science and Engineering, a student should secure a minimum of **180** credits in the course of their study. The credit requirements for their program of study is comprised of the following Programme Structure:

- **Basic Applied Sciences (BAS) and Engineering Science (ES):** The purpose of Basic Applied Sciences in Engineering study is to lay a strong foundation of basic principles of various disciplines such as Mathematics, Physics, and Chemistry in the mind of the learners so that they proceed to the rest of their years of study with up to date knowledge and training of basic engineering skills. The Engineering Sciences requirements support multiple objectives: first, the courses provide a strong foundation in the basic tools and methodologies common to all engineering disciplines; second, all the students are exposed to basics of each discipline allowing for cross-disciplinary competencies; last, there is a multi-disciplinary project component where students from different engineering disciplines come together on a design project, allowing for practice in collaborative team work.
- **Professional Core Courses (PC):** The Professional core courses are aimed at providing the student with a solid foundation in their chosen field of study as per Industry 4.0 skills and knowledge.
- **Practicals (P):** The labs are fully well equipped with latest software to conduct practical as per the requirement of the University Curriculum.
- **Professional Electives (PE)-Programme-Specific Specialization Electives:** The Professional electives, on the other hand, provide the student with an option to gain exposure to different specializations within the discipline, or an opportunity to study one of the subfields in some depth.
- **Ability Enhancement Courses (AEC):** Students are required to achieve competency in a Modern Indian Language (MIL) along with English language with special emphasis on language and communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and academic writing skills. The focus is on imparting students with necessary skills to articulate their arguments and present their thoughts clearly and coherently and recognize the importance of language as a To understand the fundamentals of big data concepts, architectures, and its growing

importance in real-world applications.

- To apply statistical and inferential techniques to analyze structured and unstructured datasets.
- To explore modern data visualization tools and techniques for meaningful representation of big data.
- To introduce OLAP, data mining, and knowledge discovery approaches for decision-making support.
- To design and implement big data solutions using Hadoop ecosystem and distributed computing tools.
- mediator of knowledge and identity.
- **Value Added Courses (VAC):** Course components relating to skills, attitudes, and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living health and wellness seek to promote an optimal state of physical, emotional, intellectual, social, spiritual, and environmental well-being of a person, the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties.

➤ **Skill Enhancement Courses (SEC)-Technical & Soft Skills:**

**Technical Skills:** Under Technical Skills Broad categories of training to be imparted in Engineering Graduates of various disciplines with common nomenclature. The training is categorized into three categories: Elementary, Intermediate & Advanced keeping in view of the interdisciplinary approach. (One Credit Each from 3<sup>rd</sup> semester to 6<sup>th</sup> semester)

**Soft Skills:** Under Soft skills training five soft skill courses with defined Nomenclature and course content common to all Engineering disciplines are introduced to inculcate Group Dynamics, Team work & Leadership Traits by engaging students in interactive sessions through Role Play, Group Discussions, and improving presentation & Communication skills of engineering graduates. (One Credit Course from 3<sup>rd</sup> Semester to 7<sup>th</sup> semester).

➤ **Live Projects (LP) and Summer Internship (SI):**

**Live Projects** is being introduced for all Engineering disciplines from 5<sup>th</sup> semester - 7<sup>th</sup> Semester to develop an ability in engineering graduates to apply skills and knowledge attained to solve real life complex problems. (One Credit each semester).

- A student may create a live project as an internship project. In that case, the student will be monitored on a periodic basis, both by the Industry Expert and the Faculty In-charge. The Industry In-charge will submit the Mid-Term and End-Term Evaluation report.

However, the faculty in-charge will take periodic presentations to keep a check on the progress of students.

- A student may also create a live project under the supervision of Institutional faculty (in-house or other institutes of repute). Six step comprehensive approach is introduced for Identification of Projects, Allocation & Monitoring of projects through digital platforms.

#### **Summer Internship (SI):**

Students will be monitored on a periodic basis, both by the Faculty Mentor from the Industry and the Faculty in-charge from the department. The Faculty Mentor from the Industry will submit the Mid-Term and End-Term Evaluation report. However, the faculty In-charge from the department will take periodic presentations to keep a check on the progress of Students.

- Students are provided with the internship-related document which helps them to prepare a report. In addition to this, it provides a detail to students about internship/project evaluation parameters.

#### **➤ Multidisciplinary Courses (Humanities and Social Science Courses) (MDC):**

The open elective subject courses provide the student with wide latitude to pursue their interests, be it in humanities, management, arts, or their own chosen field of study in order to have a multidisciplinary approach.

**B.TECH COMPUTER SCIENCE AND ENGINEERING TABLE 3:  
PROGRAMME STRUCTURE**

Category of Courses	Category	No. of Courses	
<b>Basic Applied Sciences</b>	BAS	7	
<b>Engineering Sciences</b>	ES	10	
<b>Professional Core</b>	PC	14	
<b>Professional Electives -Program Specific Specialized Elective Courses</b>	PE	11	
<b>Ability Enhancement Courses</b>	AEC	4	
<b>Skill Enhancement courses (Technical and Soft skills)</b>	SEC	Technical Skills	4
		Soft Skills	5
<b>Value Added Courses</b>	VAC	3	
<b>Practical / Workshop</b>	P/W	9	
<b>Live Project &amp; Industrial Visit and Summer Internship</b>	LP /SI	Live Project and Industrial Visit	5 <sup>th</sup> -7 <sup>th</sup> Semester 3
		Minor Project	7 <sup>th</sup> Semester 1
		Major Project	8 <sup>th</sup> Semester 1
<b>Multidisciplinary courses (Humanities and Social Sciences )(HSS)</b>	MDC	3	
<b>TOTAL</b>		<b>75</b>	

**BACHELOR OF TECHNOLOGY (COMPUTER  
SCIENCE AND ENGINEERING) DEGREE COURSE**

**TABLE 4: PROGRAMME CREDIT STRUCTURE SEMESTER WISE**

→ Semesters Courses	CATEGORY	I	II	III	IV	V	VI	VII	VIII	TOTAL	%AGE
Basic Applied Sciences	BAS	9	9	4	0	0	0	0	0	22	12.22
Engineering Sciences	ES	9	9	-	0	0	0	0	0	18	10.00
Professional Core Courses	PC	0	0	9	14	6	9	8	0	46	25.56
Professional Electives-Program Specific Specialization Electives	PE	0	0	3	4	11	8	8	0	34	18.89
Ability Enhancement Courses	AEC	5	2	-	-	-	0	0	0	7	3.89
Skill Enhancement Courses(Technical &Soft Skills)	SEC	0	0	2	2	2	2	1	0	9	5.00
Practicals/Workshops	P/W	0	0	3	2	1	2	1	0	9	5.00
Live Project & Industrial Visit and Summer Internship	LP/SI	0	0	0	0	1	1	6	12	20	11.11
Multidisciplinary courses (Humanities and Social Sciences )(HSS)	MDC	0	0	0	3	3	3	0	0	9	5.00
Value Added Courses	VAC	2	2	2	-	-	-	-	-	6	3.33
<b>TOTAL</b>		<b>25</b>	<b>22</b>	<b>23</b>	<b>25</b>	<b>24</b>	<b>25</b>	<b>24</b>	<b>12</b>	<b>180</b>	<b>100.0</b>

**COURSE CURRICULUM BACHELOR OF  
TECHNOLOGY  
COMPUTER SCIENCE AND ENGINEERING DEGREE COURSE  
TABLE 5: PROGRAMME COURSES CREDIT STRUCTURE SEMESTER WISE  
SEMESTER-I**

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
<b>THEORY</b>								
1	25AS101	(BAS)	Engineering Mathematics-I	3	1	0	4	4
OR								
1 (a)	25AS104	(BAS)	Mathematics-I (For BME students)	2	0	0	2	2
1 (b)	25AS109	(BAS)	Biology (For BME students)	1	1	0	2	2
2	25AS103/ 25AS105	(BAS)	Quantum Computation and Communication / Applied Chemistry	3	1	0	4	4
3	25EE101/ 25EC101	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	25ME101	(ES)	Fundamentals of Robotics and AI	3	0	0	3	3
	OR							
	25CS101	(ES)	Fundamentals of Computer & C Programming	3	0	0	3	3
5	25HS101	(AEC)	Communicative English	2	0	0	2	2
6	25HIN101 / 25FLGR101 / 25FLFR101	(AEC)	Hindi-I/German-I/French-I	2	0	0	2	2
7	25ESEB101/ 25VAC101	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
<b>Total Credits (Theory)</b>				<b>18/16</b>	<b>2</b>	<b>0</b>	<b>20/18</b>	<b>20/18</b>
<b>PRACTICAL</b>								
8	25AS153/ 25AS155	(BAS)	Quantum Physics Lab / Applied Chemistry Lab	0	0	2	2	1
9	23EE151/25EC151	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	25ME151/25CS151	(ES)	Design thinking and Engineering practices Lab / C Programming Lab	0	0	2	2	1
11	25ME153/25HS151	(ES)/ (AEC)	Engineering Graphics & Design Lab/ Communicative English Lab	0	0	2	2	1
<b>Total Credits (Practical)</b>				<b>0</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>4</b>
<b>TOTAL CREDITS (THEORY + PRACTICAL)</b>				<b>18/16</b>	<b>2</b>	<b>8</b>	<b>28/26</b>	<b>24/22</b>

L= Lecture, T = Tutorials, P = Practical's & C = Credits]

## SEMESTER-II

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
<b>THEORY</b>								
1	25AS201	(BAS)	Engineering Mathematics-II	3	1	0	4	4
OR								
1 (a)	25AS204	(BAS)	Mathematics-II(For BME students)	2	0	0	2	2
1 (b)	25AS109	(BAS)	Biology (For BME students)	1	1	0	2	2
2	25AS206/ 25AS208	(BAS)	Quantum Computation and Communication / Applied Chemistry	3	1	0	4	4
3	25EE202/ 25EC202	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	25ME202	(ES)	Fundamentals of Robotics and AI	3	0	0	3	3
	OR							
	25CS202	(ES)	Fundamentals of Computer & C Programming	3	0	0	3	3
5	25HS202	(AEC)	Communicative English	2	0	0	2	2
6	25HIN202 / 25FLGR202 / 25FLFR202	(AEC)	Hindi-I/German-I/French-I	2	0	0	2	2
7	25ESEB202/ 25VAC202	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
<b>Total Credits (Theory)</b>				<b>18/16</b>	<b>2</b>	<b>0</b>	<b>20/18</b>	<b>20/18</b>
<b>PRACTICAL</b>								
8	25AS256/ 25AS258	(BAS)	Quantum Physics Lab / Applied Chemistry Lab	0	0	2	2	1
9	23EE252/25EC252	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	25ME252/25CS252	(ES)	Design thinking and Engineering practices Lab / C Programming Lab	0	0	2	2	1
11	25ME254/25HS252	(ES)/ (AEC)	Engineering Graphics & Design Lab/ Communicative English Lab	0	0	2	2	1
<b>Total Credits (Practical)</b>				<b>0</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>4</b>
<b>TOTAL CREDITS (THEORY + PRACTICAL)</b>				<b>18/16</b>	<b>2</b>	<b>8</b>	<b>28/26</b>	<b>24/22</b>

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

### SEMESTER – III

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
<b>Theory</b>							
24AS301	Engineering Mathematics-III	BAS	3	1	0	4	4
25CS2001	Data Structure	PC	3	0	0	3	3
25CSPExxx	Professional Elective-I	PE	3	0	0	3	3
25CS2005	Database Management Systems	PC	3	0	0	3	3
25CS2007	Programming in Python	PC	3	0	0	3	3
<b>Total (Theory)</b>			<b>15</b>	<b>1</b>	<b>0</b>	<b>16</b>	<b>16</b>
<b>Practical</b>							
25CS2015	Python Programming Lab	P	0	0	2	2	1
25CS2111	Database Management Systems Lab	P	0	0	2	2	1
25CS2113	Data Structure Lab	P	0	0	2	2	1
23AEC301	Sports, Yoga and Fitness	AEC	1	0	2	3	2
<b>Total (Practical)</b>			<b>1</b>	<b>0</b>	<b>8</b>	<b>9</b>	<b>5</b>
<b>Skill Enhancement Course</b>							
25CS0201C	Digital Marketing	SEC	0	0	2	2	1
23SS351	Effective Communication Skills	SEC	0	0	2	2	1
<b>Total (Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>2</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>16</b>	<b>2</b>	<b>12</b>	<b>30</b>	<b>23</b>

**NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-I)**

**The XX parts of the course code will depend upon the elective chosen by the student.**

## SEMESTER - IV

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
<b>Theory</b>							
24 MDCXXX	Multidisciplinary Elective-I	MDC	3	0	0	3	3
25CSPE2004	Theory of Computation	PC	3	1	0	4	4
25CS2006	Operating Systems	PC	3	0	0	3	3
25CSPEXXX	Professional Elective -II	PE	3	0	0	3	3
25CS2010	Java Programming	PC	3	0	0	3	3
25CS2004	Discrete Structures	PC	3	1	0	4	4
<b>Total (Theory)</b>			<b>18</b>	<b>2</b>	<b>0</b>	<b>20</b>	<b>20</b>
<b>Practical</b>							
25CS2114	Operating Systems Lab	P	0	0	2	2	1
25CS2116	Java Programming Lab	P	0	0	2	2	1
25CSPEXXX	Professional Elective -II Lab	PE	0	0	2	2	1
<b>Total (Practical)</b>			<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>3</b>
<b>Skill Enhancement Course</b>							
25CS0202B	Design Thinking and Augmented Virtual Reality	SEC	0	0	2	2	1
23SS452	Teamwork & Interpersonal Skills	SEC	0	0	2	2	1
<b>Total (Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>2</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>18</b>	<b>2</b>	<b>10</b>	<b>30</b>	<b>25</b>

**NOTE:** At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-I)

The XX parts of the course code will depend upon the elective chosen by the student.

## SEMESTER – V

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
<b>Theory</b>							
24MDCXXX	Multidisciplinary Elective-II	MDC	3	0	0	3	3
25CSPE3001	Compiler Design	PC	3	1	0	4	4
25CSPExxx	Professional Elective -III	PE	3	1	0	4	4
25CSPExxx	Professional Elective -IV	PE	3	0	0	3	3
25CSPExxx	Professional Elective -V	PE	3	0	0	3	3
<b>Total (Theory)</b>			<b>15</b>	<b>2</b>	<b>0</b>	<b>17</b>	<b>17</b>
<b>Practical</b>							
25CSPE3113	Professional Elective -III Lab	PE	0	0	2	2	1
25CSPExxx	Compiler Design Lab	P	0	0	2	2	1
25CS0303A	Live Project-I &Industrial Training	LP**	0	0	2	2	1
25CS2115	Programming using MATLAB	PC	1	0	2	3	2
<b>Total (Practical)</b>			<b>1</b>	<b>0</b>	<b>8</b>	<b>9</b>	<b>5</b>
<b>Skill Enhancement Course</b>							
25CS0301A	Wearable Technology	SEC	0	0	2	2	1
23SS553	Presentation Skills	SEC	0	0	2	2	1
<b>Total (Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>2</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>16</b>	<b>2</b>	<b>1</b>	<b>30</b>	<b>24</b>

**NOTE:** At the end of the 4<sup>th</sup> semester, students will undergo a summer training and create a project which will be evaluated in the current semester (Live Project-I)

The XX parts of the course code will depend upon the elective chosen by the student.

**\*\*Students may opt one course in 5th semester and one course in 6th semester apart from the elective list (as elective) from NPTEL on recommendation of the departmental committee. The Subject should not have been previously studied.**

## SEMESTER – VI

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
<b>Theory</b>							
25CS3002	Artificial Intelligence & Expert System	PC	3	0	0	3	3
25CSPE3004	Software Engineering	PC	3	0	0	3	3
25CS3012	Big data & Analytics	PC	3	0	0	3	3
25CSPExxx	Professional Elective – VI	PE	3	1	0	4	4
25CSPExxx	Professional Elective – VII	PE	3	1	0	4	4
24MDCXXX	Multidisciplinary Elective-III	MDC	3	0	0	3	3
<b>Total (Theory)</b>			<b>18</b>	<b>2</b>	<b>0</b>	<b>20</b>	<b>20</b>
<b>Practical</b>							
25CS3114	Artificial Intelligence & Expert System Lab	P	0	0	2	2	1
25CSPE3118	Software Engineering Lab	P	0	0	2	2	1
25CS0304A	Live Project-II& Industrial Visit	LP**	0	0	2	2	1
<b>Total (Practical)</b>			<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>3</b>
<b>Skill Enhancement Course</b>							
25CS0302D	Data Analytics Tools	SEC	0	0	2	2	1
23SS654	Professional Skills	SEC	0	0	2	2	1
<b>Total (Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>2</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>18</b>	<b>2</b>	<b>10</b>	<b>30</b>	<b>25</b>

**NOTE: At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-IV)**

**\* To be evaluated in the current semester.**

**\*\*Students may opt one course in 5th semester and one course in 6th semester apart from the elective list (as elective) from NPTEL on recommendation of the departmental committee. The Subject should not have been previously studied.**

**The XX parts of the course code will depend upon the elective chosen by the student.**

## SEMESTER – VII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL	
<b>Theory</b>							
25CS4003	Cloud Computing	PC	3	1	0	4	4
25CS4005	Web Application Development	PC	3	1	0	4	4
25CSPExxx	Professional Elective Course – VIII	PE	3	1	0	4	4
25CSPExxx	Professional Elective Course – IX	PE	3	1	0	4	4
<b>Total (Theory)</b>			<b>12</b>	<b>4</b>	<b>0</b>	<b>16</b>	<b>16</b>
<b>Practical</b>							
25CS4113	Cloud Computing Lab	P	0	0	2	2	1
25CS4115A	Live project-III & Industrial Training	LP**	0	0	2	2	1
25CS4117A	Minor Project	LP	0	0	10(8)	8	5
<b>Total (Practical)</b>			<b>0</b>	<b>0</b>	<b>12</b>	<b>12</b>	<b>7</b>
<b>Skill Enhancement Course</b>							
23AR755	Aptitude and Reasoning	SEC	0	0	2	2	1
<b>Total (Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>1</b>	<b>4</b>	<b>1</b>	<b>30</b>	<b>2</b>
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>2</b>	<b>4</b>	<b>4</b>	<b>30</b>	<b>4</b>

**NOTE:** At the end of the semester, students will undergo a training and create a project which will be evaluated in the next semester (Live Project-IV)

\* To be evaluated in the current semester.

The XX parts of the course code will depend upon the elective chosen by the student.

## SEMESTER - VIII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL	
25CS4114	Major Project	LP	0	0	24	24	12
<b>Total (Theory + Practical+ Skill Enhancement)</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>24</b>	<b>12</b>

*\* To be monitored at the Institute Level*

*\*\* Teaching Load*

### LIST OF ABILITY ENHANCEMENT COURSES

Course Code	Course	Category	L	T	P	Credits
24HS101/24HS201/ 24HS151/24HS251	Communicative English/ Communicative English Lab	AEC	2	0	2	3
24HIN-101- I /24FLFR101-I /24FLGR101-I	Hindi-I/French-I/ German-I	AEC	2	0	0	2
24HIN-201- II /24FLF R201-II /24FLGR201-II	Hindi-II/French-II/German-II	AEC	2	0	0	2

### SKILL ENHANCEMENT COURSES (SEC)

Category	Course Code	Course Name	L	T	P	Credits
<b>Technical Training</b>						
SEC	25CS0201A/24ME02 01/25CS0201B/24CE 0201	Data Structure and Algorithms using C++/Industrial Automation Level-I/ Digital Marketing/Fundamentals of CAD for Engineers	0	0	2	1
SEC	25CS0202A/25CS020 2B	Design Thinking and Augmented Virtual Reality/Programming Using Python for Engineers	0	0	2	1
SEC	25CS0301A/25CS030 1B/25CS0301C/24M E0301/24CE0301	Wearable Technology/Big Data Analytics, Tools and Techniques/Machine Learning using Python/Industrial Automation Level-II/RCC Structural Drawing Training	0	0	2	1
SEC	25CS0302A/24EC030 2/24CE0302/25CS03 02B	Artificial Intelligence and Machine Learning/MATLAB for Engineers/ Structural Analysis using FEM-based Tools/Data Analytics Tools	0	0	2	1
SEC	24CE0401/24EC0401 /25CS0401	Building information modeling/ FPGA for Embedded Systems/Essentials of Blockchain and IoT	0	0	2	1

### LIST OF VALUE ADDED COURSES

Course Code	Course	Category	L	T	P	C
23VAC101/23VAC201	Environment protection and Sustainable Development	VAC	2	0	0	2
23VAC102/23VAC202	Indian Constitution and Polity	VAC	2	0	0	2
23VAC103	Sports, Yoga and Fitness	VAC	1	0	2	2

### MULTI-DISCIPLINARY COURSES (MDC)

Total: 9 (3*3) Credits						
Code	Category	Course	L	T	P	C
23MDC101/24MDC401B/25MDC605/24MDC101C/24MDC101D	( MDC-I)	Statistical Methods/Computer-Based Numerical and Statistical Technique/Probability and Random Process/Biostatistics/Numerical Methods	3	0	0	3
23MDC102		Environmental Geosciences & Disaster Management	3	0	0	3
23MDC301		IPR in Business	3	0	0	3
23MDC302		Library Information Sciences & Media Literacy	3	0	0	3
23MDC401		Management Process & Organizational Behaviour	3	0	0	3
23MDC103	(MDC-II)	Photonics	3	0	0	3
23MDC104		Chemistry & Society	3	0	0	3
23MDC303		Psychology and Emotional Intelligence	3	0	0	3
23MDC304		Indian Economy	3	0	0	3
23MDC402		Creating an Entrepreneurial Mind	3	0	0	3
24MDC 106A/24MDC 106B		Numerical Methods in BME/Discrete Mathematics	3	0	0	3
23MDC105	(MDC-III)	Life Sciences & Public Health	3	0	0	3
23MDC305		Electoral Literacy in India	3	0	0	3
23MDC403		Personal Financial Planning	3	0	0	3
23MDC404		Interior Design	3	0	0	3
24MDC107		Probability & Statistics	3	0	0	3
<b>Note</b>						
1. These courses will be of introductory level and shall have 3 credits.						
2. Students will not be allowed to choose or repeat the courses already gone through in class XII and present in Program core and specialization.						
3. Students will have the option to choose any 3 out of the pool.						
*The course shall be based on applications, tools and techniques.						

## LIST OF PROFESSIONAL ELECTIVE COURSES

<b>Specialization-I</b>									
Elective	Course Code	Course	Category	L	T	P	C		
I	25CSPE2007	Computer Architecture & Organization	PE	3	1	0	4		
II	25CSPE2008 / 25CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4		
III	25CSPE3003 / 25CSPE3113	Computer Networks / LAB	PE	3	0	2	4		
IV / V	25CSPE3027	Optimization Techniques	PE	3	0	0	3		
	25CSPE3035	Distributed Databases	PE	3	0	0	3		
	25CSPE3019	Computer Graphics	PE	3	0	0	3		
	25CSPE3021	System Modelling and Simulation	PE	3	0	0	3		
	25CSPE3023	Digital Image Processing	PE	3	0	0	3		
	25CSPE3033	Principles of Programming Languages	PE	3	0	0	3		
VI/VII	25CSPE3020	Distributed Operating System	PE	3	1	0	4		
	25CSPE3024	Software Project Management	PE	3	1	0	4		
	25CSPE3026	Grid Computing	PE	3	1	0	4		
	25CSPE3028	Object Oriented Analysis & Design	PE	3	1	0	4		
	25CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4		
	25CSPE3032	Cyber Security	PE	3	1	0	4		
VIII /IX	25CSPE4019	Network Security & Cryptography	PE	3	1	0	4		
	25CSPE4033	Software Testing	PE	3	1	0	4		
	25CSPE4023	Wireless Adhoc and Sensor Network	PE	3	1	0	4		
	25CSPE4035	Advanced Java Programming	PE	3	1	0	4		
	25CSPE4037	NASSCOM Associate Analytics - II	PE	3	1	0	4		
	25CSPE4025	Data Warehousing & Data Mining	PE	3	1	0	4		
	25CSPE4029	Machine Learning Using R	PE	3	1	0	4		

Specialization-II							
Elective	Course Code	Course	Category	L	T	P	C
I	25CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	25CSPE2008/ 25CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4
III	25CSPE3003/ 25CSPE3113	Computer Networks / LAB	PE	3	0	2	4
IV/V	25CSPE3025	Visual Programming	PE	3	0	0	3
	25CSPE3033	Principles of Programming Languages	PE	3	0	0	3
	25CSPE3039	Block Chain	PE	3	0	0	3
	25CSPE3037	Theory of App Development	PE	3	0	0	3
	25CSPE3041	Data Science	PE	3	0	0	3
	25CSPE3031	Soft Computing		3	0	0	3
VI/VII	25CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	25CSPE3032	Cyber Security	PE	3	1	0	4
	25CSPE3034	Design Thinking	PE	3	1	0	4
	25CSPE3036	Predictive Analytics	PE	3	1	0	4
	25CSPE3038	Business Intelligence	PE	3	1	0	4
	25CSPE3040	Internet of Things	PE	3	1	0	4
VIII/ IX	25CSPE4019	Network Security & Cryptography	PE	3	1	0	4
	25CSPE4027	Mobile Computing	PE	3	1	0	4
	25CSPE4029	Machine Learning Using R	PE	3	1	0	4
	25CSPE4031	Open Source Software	PE	3	1	0	4
	25CSPE4039	NASSCOM Associate Analytics – III	PE	3	1	0	4
	25CSPE4041	Advanced Internet of Things	PE	3	1	0	4
	25CSPE4047	Advanced Block Chain	PE	3	1	0	4

	Specialization-III						
Elective	Course Code	Course	Category	L	T	P	C
I	25CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	25CSPE2008/ 25CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4
III	25CSPE3003/ 25CSPE3113	Computer Networks / LAB	PE	3	0	2	4
IV/ V	25CSPE3035	Distributed Databases	PE	3	0	0	3
	25CSPE3019	Computer Graphics	PE	3	0	0	3
	25CSPE3023	Digital Image Processing	PE	3	0	0	3
	25CSPE3033	Principles of Programming Languages	PE	3	0	0	3
	25CSPE3039	Block Chain	PE	3	0	0	3
	25CSPE3031	Soft Computing	PE	3	0	0	3
VI/ VII	25CSPE3020	Distributed Operating System	PE	3	1	0	4
	25CSPE3024	Software Project Management	PE	3	1	0	4
	25CSPE3028	Object Oriented Analysis & Design	PE	3	1	0	4
	25CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	25CSPE3034	Design Thinking	PE	3	1	0	4
	25CSPE3038	Business Intelligence	PE	3	1	0	4
VIII /IX	25CSPE4019	Network Security & Cryptography	PE	3	1	0	4
	25CSPE4033	Software Testing	PE	3	1	0	4
	25CSPE4035	Advanced Java Programming	PE	3	1	0	4
	25CSPE4029	Machine Learning Using R	PE	3	1	0	4
	25CSPE4041	Advanced Internet of Things	PE	3	1	0	4
	25CSPE4047	Advanced Block Chain	PE	3	1	0	4

## SEMESTER - I & SEMESTER - II

ENGINEERING MATHEMATICS-I	
Course Code: 25AS101	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: 12 <sup>th</sup> Mathematics	

### COURSE OBJECTIVES (COs)

1. To provide students the understanding of matrices and its applications.
2. To introduce the concept of functions of several variables, Partial differentiation, and its applications.
3. To demonstrate the applications of Multiple Integrals.
4. To describe the concepts of vector calculus.
5. To illustrate the concept of convergence, divergence of sequences and series of real numbers and improper integration.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Apply the techniques of matrices to real-world mathematical and computational problems.
2. Apply the knowledge of partial differentiation in engineering problems.
3. Calculate line, surface, and volume integrals.
4. Illustrate different real-world problems related to vector calculus
5. Explain convergence behaviour of sequences and series of real numbers and improper integration.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	x				
C02		x			
C03			x		
C04				x	
C05					x

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
<b>UNIT-I</b>	Matrix: Types of Matrices, Elementary Transformations, Inverse of a square matrix by elementary transformation, Rank of a matrix (Echelon and Normal forms), Linear Dependence & Independence of vectors, Solution of system of linear equations ( $AX = 0$ and $AX = B$ ), Eigenvalues and Eigenvectors, Cayley Hamilton theorem.  Application domain problems: Cryptography (Coding and Decoding), Image and Image Processing, data storage and analysis.	12
<b>UNIT-II</b>	Functions of several variables, Partial Derivatives,	

	Homogenous function, Euler's theorem for homogenous functions, Deductions from Euler's theorem, Total Derivatives, Chain Rule, Composite function of two variables, Differentiation of implicit functions, Applications of Partial Derivatives- Taylor's theorem for two variables, Maxima and minima for two variables, Jacobians. Application domain problems: Approximations and error analysis	12
<b>UNIT-III</b>	Multiple integral: Evaluation of Double integrals, Change of Order of Integration, Double integration in polar coordinates, Change of Variables, Triple integrals - Evaluation of triple integrals over a given region, Applications of Multiple Integrals – Area (Cartesian Coordinates). Beta and Gamma functions and their properties. Application domain problems: Centre of Mass, Moment of Inertia, Solid of revolution and Kinetic energy	12
<b>UNIT-IV</b>	Vector calculus: Differentiation of vectors, Scalar and vector point functions, Gradient, Divergence, Curl, Directional derivatives, Vector Integration- Line, Surface and Volume integrals, Green's Theorem, Gauss' divergence theorem and Stroke's theorem (without proof). Application domain problems: Equation of continuity, Equation of motion, Inverse square law of force	12
<b>UNIT-V</b>	Sequence & Series: Convergence, divergence and oscillation of a series, Geometric Series, General properties of series, Test of convergence – Comparison test, Integral test, Comparison of Ratios, D'Alembert's Ratio test, Cauchy root test. Application domain problems: Computational geometry, Image processing.	12

#### TEXT BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2020.
2. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 7th Edition, Narosa Publishing House, 2021.
3. Kreyszig, E, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. Singapore, 2017.
4. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.

#### REFERENCE BOOKS

1. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
2. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

<b>Mathematics-I (For BME only)</b>	
<b>Course Code:</b> 25AS104	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To introduce the concept of Matrices and Determinants.
2. To demonstrate the concept of Differentiation.
3. To introduce the concept of Integration.
4. To create the knowledge of Differential Equations.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of matrices and determinants.
2. Apply the knowledge of differentiation in Bio-engineering.
3. Solve problems related to integration.
4. Illustrate the concepts of differential equations.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
CO1	x			
CO2		x		
CO3			x	
CO4				x

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	Introduction of matrices, Types of Matrices, Operations on Matrices, Transpose of a Matrix, Symmetric and Skew- Symmetric Matrices, Elementary Operation of a Matrix, Invertible Matrices. Introduction of Determinant, Properties of Determinants, Area of a triangle, Minor and Cofactors, Adjoint and Inverse of a Matrix. Application domain problems: Image and Image Processing, data storage and analysis, Gene sequencing, RNA, DNA analysis.	7
<b>UNIT-II</b>	Introduction, Continuity, Differentiability-Chain Rule, Derivatives of implicit functions, Derivatives of Trigonometric functions and Inverse trigonometric functions, Derivatives of Exponential and Logarithmic functions. Application domain problems: Enabling the modeling and analysis of dynamic biological systems.	7
<b>UNIT-III</b>	Introduction, Elementary Properties, Integration by method of Substitution, Integration using trigonometric identities, Integration by Partial fractions, Integration by parts. Application domain problems: Analyzing medical data	7

<b>UNIT-IV</b>	Introduction, Order and Degree of Differentiation equation, Solution of first order differential equations by method of variable separable, Homogeneous, Linear differential equation, Reducible to linear differential equation, Exact differential equation. Application domain problems: Various biological components interact and change over time, Epidemiology	7
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#### TEXT BOOKS

1. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford first edition, 2015.
2. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44<sup>th</sup> Edition, 2017.
3. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 6<sup>th</sup> Edition, Narosa Publishing House, 2019.
4. Kreyszig. E, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons. Singapore, 2015.

#### REFERENCE BOOKS

1. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

<b>BIOLOGY (For BME only)</b>	
<b>Course Code:</b> 25AS109	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 1 1 0	
<b>Prerequisite:</b> Nil	

### COURSE OBJECTIVES (COs)

1. To study the basic living structure and their functions.
2. To focus on different physiological processes and introduce the concept of cell signaling and their role in diseases.
3. To understand the fundamental concepts of genetics in prokaryotes and eukaryotes.
4. To learn about the various levels of organization that plants and animals have, as well as the various activities that they do.
5. To investigate biological topics using a scientific method and get well-informed findings.
6. To integrate biological and engineering knowledge.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the complicated relationship between different cellular structures and their roles.
2. Employ experimental ways to solve genetic problems.
3. Explain how animals respond to changes in their environment.
4. When dealing with biological impediments and challenges, problem-solving abilities should be applied.
5. Analyze and interpret the data using appropriate biological methods.
6. Make connections between the various portions of the topics covered in the course.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	x					
CO2	x	x				
CO3		x	x			
CO4				x	x	
CO5				x	x	
CO6					x	x

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
<b>UNIT-I</b>	<b>NATURE OF LIVING THINGS</b> Definition of life, Miller's experiment, theories and evidence of origin of life, levels of biological organization, classification of living world, difference between prokaryotes and eukaryotes, Evolutionary processes: Lamarckism, Darwinism, role of mutations and isolating mechanisms, adaptive radiation.	8
<b>UNIT-II</b>	<b>MOLECULAR ORGANIZATION OF CELL</b> Difference between animal and plant cell, salient features of intracellular organelles, cell division and cell cycle. Basic idea for Cell division, Mitosis, Meiosis. Basic idea how Central Dogma of life, Introduction to major biomolecules Carbohydrates, fats and proteins.	8

<b>UNIT-III</b>	<b>FUNDAMENTALS OF GENETICS</b> Mendelian principles, pleiotropy, epistasis, linkage and crossing over, Mendel's laws - monohybrid - dihybrid inheritance- multiple alleles- structure and organization of chromosome in prokaryote and Eukaryotes. Linkage - types of linkage -crossing over and their types.	7
<b>UNIT-IV</b>	<b>UNIT IV: PHYSIOLOGY</b> Animal Physiology: Hormones and their mode of action, types of asexual and sexual reproduction, stages of embryogenesis.	7

#### TEXT BOOKS

1. Purves et al, Life: The Science of Biology.
2. R. Dulbecco, The Design of Life.
3. Samantha Fowler, Concepts of Biology, Publisher: OpenStax.
4. J. M. Mwaniki, Fundamentals of Biology, Longhorn Publishers and Worldreader

#### REFERENCE BOOKS

1. Keith Wilson & John Walker, "Practical Biochemistry - Principles & Techniques", Oxford University Press.
2. Thyaga Rajan S, Selvamurugan N, Rajesh M.P, Nazeer, Richard Thilagaraj R.A. Barathi. W.S and. Jaganathan, M.K "Biology for Engineers", W.H. Hill, New Delhi.
3. Robert Weaver, "Molecular Biology", MCGraw-Hill.
4. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
5. Fundamentals Of Biology -Haupt Arthur W Books Publisher: Read Books Genre: Science, ISBN: 9781406707397, 97814067073
6. Basic Concepts In Biology 6/E by Starr Cengage Learning Inc

QUANTUM COMPUTATION AND COMMUNICATION	
Course Code: 25AS103/25AS206	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

### COURSE OBJECTIVES (COs)

1. To reinforce the classical foundations relevant to modern physics and quantum theory.
2. To introduce key experiments and principles that led to the development of quantum mechanics.
3. To develop a conceptual and mathematical understanding of quantum mechanics and its postulates.
4. To introduce the Dirac notation and operator formalism central to quantum computation.
5. To familiarize students with classical and quantum logic gates and their role in quantum algorithms.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Analyse and solve problems related to classical systems including SHM, resonance, and LCR circuits.
2. Interpret foundational experiments like black body radiation, photoelectric effect, and Compton scattering within the quantum framework.
3. Apply the uncertainty principle, Schrödinger equation, and quantum postulates to idealized systems such as the particle in a 1D box.
4. Represent quantum states and operators using Dirac notation and apply linear algebra tools such as eigenvalues and commutators.
5. Differentiate between classical and quantum logic gates and construct basic quantum circuits using standard gate sets.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	x				
C02	x	x			
C03			x		
C04				x	
C05					x

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
UNIT-I	<b>CLASSICAL PHYSICS:</b> Review of Newtonian Mechanics, Simple Harmonic Motion (SHM), Differential Equation of SHM and its Solutions, Conservation of Energy. Mass-string System, Simple pendulum, LC circuit, Qualitative discussion of damped harmonic and forced harmonic motion, resonance and its applications.	10
UNIT-II	<b>BASICS OF QUANTUM MECHANICS:</b> Black body problem, Photoelectric effect and Compton scattering (conceptual), stability of atom, dual nature of light and matter, de-Broglie Hypothesis of	10

	matter waves, Phase & Group velocities, Davison-Germer experiment.	
<b>UNIT-III</b>	<b>APPLICATIONS OF QUANTUM MECHANICS:</b> Uncertainty principle, application of uncertainty principle, significance of wave functions, postulates of quantum mechanics, Schrodinger time dependent and time independent equations, particle in a box (1-D infinite potential well).	<b>10</b>
<b>UNIT-IV</b>	<b>MATHEMATICAL TOOLS OF QUANTUM COMPUTATION:</b> Dirac notation: properties of kets and bras, bra-ket algebra and their matrix representation, Operators and its matrix representation: Hermitian adjoint, Hermitian conjugate rules, Hermitian and skew-Hermitian, projection operators, commutators algebra, inverse and unitary operators, Eigenvalues and Eigenvectors of an operator.	<b>15</b>
<b>UNIT-V</b>	<b>QUANTUM COMMUNICATION:</b> Classical gates (AND, OR, NOT, NAND, XOR), Qubit and its physical realization, Bloch sphere, Quantum logic gates and matrix forms, Pauli Gates: X, Y, Z gates, Hadamard Gate, S and T gates, identity gate, CNOT gate, controlled-Z gate. Application of quantum gates in quantum computation.	<b>15</b>

#### TEXT BOOKS

1. David J. Griffiths, *Introduction to Quantum Mechanics*, 2nd Edition, 2004, Pearson Education.
2. Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, 10th Anniversary Edition, 2010, Cambridge University Press.
3. H.C. Verma, *Concepts of Physics*, Volume 1, 2008, Bharati Bhawan Publishers.

#### REFERENCE BOOKS

1. Nouredine Zettili, *Quantum Mechanics: Concepts and Applications*, 2nd Edition, 2009, Wiley.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, 2011, MIT Press.
3. J.J. Sakurai and Jim Napolitano, *Modern Quantum Mechanics*, 2nd Edition, 2011, Cambridge University Press.
4. Albert Paul Malvino, Donald P Leach, Goutam Saha, *Digital principles and applications*, 7<sup>th</sup> Edition, 2011, Tata McGraw-Hill Pvt. Ltd.

<b>Quantum Physics Lab</b>	
<b>Course Code:</b> 25AS153/25AS256	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

#### COURSE OBJECTIVES (COs)

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. To apply the analytical techniques and graphical analysis to the experimental data.

#### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Use the different measuring devices and meters to record the data with precision.
2. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
3. Apply the mathematical concepts/equations to obtain quantitative results.

#### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3
C01	x		
C02		x	
C03		x	x

#### LIST OF EXPERIMENTS

(Students are required to complete/perform any 10 experiments from the list below)

Experiment 1: To study the characteristic of LDR and finding the dark resistance.

Experiment 2: To determine the wavelength of sodium light by Newton's ring experiment.

Experiment 3: To determine the wavelength of the given laser source using standard grating.

Experiment 4: To determine Planck's constant.

Experiment 5: To study the I-V characteristics of a PN junction diode.

Experiment 6: To determine the energy band gap by four-probe method.

Experiment 7: To study the solar cell characteristic.

Experiment 8: To determine the dispersive power of a given prism.

Experiment 9: To determine the moment of inertia of the disc and rigidity modulus of the wire by torsional pendulum.

Experiment 10: e/m by J.J. Thomson

Experiment 11: Stern - Gerlach experiment

Experiment 12: Logic gates.

#### TEXT BOOKS

1. Chattopadhyay, D., Rakshit, P. C and Saha, B., "An advanced Course in Practical Physics", 2<sup>nd</sup> edition, Books & Allied Ltd, Calcutta, 1990.
2. Chauhan and Singh, "Advanced practical physics", Revised edition, Pragati Prakashan Meerut, 1985.

## REFERENCE BOOKS

1. Thiruvadigal. J. D., Ponnusamy S. Vasuhi, P. S. and Kumar. C, "Hand Book of Practical physics", 5<sup>th</sup> edition, Vibrant Publication, Chennai, 2007.
2. Engineering Practical Physics, by S. Panigrahi and B. Mallick, (CENGAG Elearning).

<b>Applied Chemistry</b>	
<b>Course Code:</b> 25AS105 /25AS208	<b>Continuous Evaluation: 40 Marks</b>
<b>Credits:</b> 4	<b>End Semester Examination:60 Marks</b>
<b>L T P :</b> 3 1 0	
<b>Prerequisite:</b> Nil	

#### COURSE OBJECTIVES (COs)

1. The knowledge of fundamentals of water quality parameters and the treatment of water.
2. To understand the fundamental concepts of electrochemistry and corrosion.
3. To explain states of matter, phase diagram and related applications.
4. To learn various types of polymers, and to understand the basics of spectroscopy.
5. To learn an introductory idea about nanomaterials.

#### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and analyze the quality of water.
2. Demonstrate the working of electrochemical cells and batteries.
3. Explain states of matter, phase diagram, related applications.
4. Analyze the application aspects of polymers and spectroscopy.
5. Describe the properties of nanomaterials and its synthesis.

#### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	x				
C02	x	x			
C03			x		
C04				x	
C05					x

#### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
<b>UNIT-0</b>	<b>Introduction:</b> Atomic and molecular masses, mole concept and molar mass, percentage composition, redox reactions, Chemical and ionic equilibrium; Acid & bases.	<b>6</b>
<b>UNIT-I</b>	<b>Water Technology:</b> Reasons for hardness-units of hardness-determination of hardness and alkalinity-Water for steam generation-Boiler Troubles-Scale, Sludge formation, Boiler corrosion, Caustic Embrittlement-Internal Treatments-Softening of Hard water- Ion Exchange process -Water for drinking purposes-Purification-Sterilization and disinfection: Chlorination, Reverse Osmosis and Electro Dialysis.	<b>10</b>
<b>UNIT-II</b>	<b>Electrochemistry:</b> Nernst Law and its applications, Electrode Potential, Electrochemical cell, Concentration Cell, Electrochemical Series, Batteries and Cells; Primary Batteries and Secondary Batteries.	<b>16</b>

	<b>Corrosion:</b> Electrochemical theory of corrosion, Galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlement in boilers), Factors affecting, metal coatings- Galvanizing and Timing, Corrosion inhibitors, protection.	
<b>UNIT-III</b>	<b>The Phase rule:</b> Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of one component system-water system, Condensed phase rule, Phase diagram of two components System-Eutectic, Pb-Ag system.	<b>8</b>
<b>UNIT-IV</b>	<b>Polymer:</b> Terminologies, Classification of polymer, Preparation of special polymer-Nylon6,6, Polyethylene, Polystyrene, Teflon, Polymethyl-methacrylate, Bakelite. <b>UV Spectroscopy:</b> Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, effect of conjugation on chromophores.	<b>12</b>
<b>UNIT-V</b>	<b>Nano Materials:</b> Introduction and classification (0D, 1D, 2D) with examples, size dependent properties, Top-down and Bottom-up approaches of nanomaterial synthesis. Introductory idea on synthesis of nanomaterials <i>via</i> green synthetic route.	<b>8</b>

#### TEXT BOOKS

1. Engineering Chemistry (NPTEL web-book) by B. L. Tembe, Kamaluddin, and M.M. S. Krishan.
2. Fundamentals of Molecular Spectroscopy by Banwell, Tata McGraw-Hill Education.
3. Textbook of Nanoscience and Nanotechnology, McGraw Hillw Hill Education (India) Pvt. Ltd., 2012.) Pvt. Ltd., 2012.
4. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publication.
5. Engineering Chemistry by Prasanta Rath, Cenage Learning India Private Ltd., 2015.td., 2015.
6. A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co., 2020 & Co., 2020.
7. Inorganic Chemistry by Donald A. Tarr and Gary Miessler, Pearson India, Third Edition.
8. Molecular Spectroscopy, Ira N. Levine, John Wiley and Sons.

#### REFERENCE BOOKS

1. Inorganic Chemistry by W. Overton, Rounk, and Armstrong, Oxford University Press, 6<sup>th</sup> edition.
2. Advanced Engineering Chemistry by M.R. Senapati, University Science Press, India.
3. A Textbook of Engineering Chemistry by S. S. Dara, 10th Edition, S. Chand & Company Ltd., New Delhi, 2003.
4. J.D. Concise Inorganic Chemistry.
5. Inorganic Chemistry, Catherine E. Housecroft and Alan G. Sharpe, 2<sup>nd</sup> Edition
6. Huheey, J. E., Keiter, E. A., Keiter, R. L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India.

<b>Applied Chemistry Lab</b>	
<b>Course Code:</b> 25AS155/25AS258	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

### COURSE OBJECTIVES (COs)

An integrated laboratory course consists of experiments from applied chemistry and is designed:

1. To impart the knowledge and understanding of principles of measurement techniques.
2. To understand the principle involved in the synthesis of chemical compounds, and quantitative analysis.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the basic concepts of measurement techniques.
2. Execute synthesis of compounds and determination quantitative analysis.

### Mapping Matrix of Course Objectives (COs) and Course Learning Outcomes (CLOs)

COs/CLOs	CLO1	CLO2
CO1	x	
CO2		x

### LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum 8-10 of experiments)

1. Determination of total hardness of water by EDTA method.
2. Determination of dissolved oxygen in a sample of water.
3. Determination of percentage of available chlorine in a sample of bleaching powder.
4. Standardization of  $\text{KMnO}_4$  using sodium oxalate. Determination of ferrous iron in Mohr's salt by potassium permanganate.
5. Determination of Viscosity of addition polymer by Ostwald Viscometer.
6. Determination of alkalinity of given sample.
7. Estimation of calcium in limestone.
8. Acid-Base Titration by Potentiometry.
9. Preparation of Silver/Iron nano particles.
10. Preparation of Bakelite.
11. Preparation of Urea formaldehyde resin.
12. To record UV-Spectrum of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$ .
13. Estimation of nickel in given sample solution
14. Estimation of nitrite in given sample solution.

### TEXT BOOKS

1. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney, Longman Scientific & Technical, England

2. Applied Chemistry: Theory and Practice (Latest ed.), by O.P. Vermani & A.K. Narula, New Age International Publications.

#### REFERENCE BOOKS

1. Dara, S.S.; A text book on Experiments and Calculations in Engineering Chemistry (ninth edition); S. Chand, 2003.
2. Rani, S.; Laboratory Manual on Engineering Chemistry; Dhanpat Rai, 1998.
3. Department Laboratory Manual.

<b>BASIC ELECTRICAL ENGINEERING</b>	
<b>Course Code:</b> 25EE202/25EE202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 3	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 3 0 0	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
2. To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
3. To understand the concept of electrical machines in real-life applications.
4. To familiarize the sources of renewable energy and electric vehicles and their progress in recent years

### **COURSE LEARNING OUTCOMES (CLOs)**

After completion of the course, students would be able to:

1. To apply various network laws and theorems in DC circuits.
2. To compute different AC quantities with phasor representation.
3. To realize the operation of single-phase circuits and induction motors
4. To understand the basic concept of a poly-phase system.
5. To define various renewable resources available in power generation.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
CO1	x				
CO2			x		
CO3		x	x	x	
CO4					x

### **COURSE CONTENT S**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<b>DC Circuits</b> Ohm's Law and Kirchhoff's Laws, Analysis of Series, parallel, and series-parallel circuits excited by independent voltage sources, Star-delta transformation, Mesh current Analysis, Node voltage analysis, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem	<b>9</b>
<b>UNIT-II</b>	<b>Single-Phase A.C. Circuits</b> Sinusoidal signal, instantaneous and peak values, RMS and average values, crest and peak factor, Concept of phase, Analysis with phasor diagrams of R-L, R-C and R-L-C circuits; Real power, reactive power, apparent power and power factor, Resonance in series R-L-C circuit, Quality factor and Bandwidth, Introduction to earthing.	<b>9</b>
<b>UNIT-III</b>	<b>Electrical Machines</b> <b>A. Transformers:</b> Magnetic circuits, Review of laws of electromagnetism, Flux, MMF and their relation, analysis of magnetic and electric circuits, Principle of operation and construction of single-phase transformers (core and	<b>9</b>

	shell types). EMF equation, losses, efficiency, and voltage regulation. <b>B. Three-Phase Induction Motor:</b> Concept of rotating magnetic field; Principle of operation, types and constructional features, Slip and its significance; Applications of squirrel cage and slip ring motors; Torque-speed characteristics of 3-phase induction motor.	
<b>UNIT-IV</b>	<b>Poly-Phase System:</b> Advantages of 3-phase system, Generation of 3-phase voltages, Voltage, current, and power in a star and delta connected systems, 3-phase balanced and unbalanced circuits, Power measurement in 3-phase circuits using the two-wattmeter method.	<b>9</b>
<b>UNIT-V</b>	<b>Renewable Sources:</b> Sources of Electrical Power, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas power plants <b>Electric Vehicles:</b> What is an EV, Benefits of EVs, EV and its types: BEV, PHEV, HEV, and FCEV, EV scenario in India.	<b>9</b>

### TEXT BOOKS

1. Fundamental of Electric Circuits by Charles K Alexander and Matthew N.O.Sadiku, TMH Publication.
2. Electrical Engineering Fundamentals by Vincent DelToro, PHI Publication.
3. Basic Electrical Engineering by V N Mittal & Arvind Mittal, TMH Publication.
4. Basic Electrical Technology by A.E.Fitzgerald, McGrawHill Publication.

### REFERENCE BOOKS

1. Kothari DP and Nagrath IJ, "Basic Electrical Engineering", Tata McGrawHill, 1991.

<b>BASIC ELECTRICAL ENGINEERING LAB</b>	
<b>Course Code:</b> 23EE151/23EE252	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To impart basic knowledge of electrical quantities such as current, voltage, power, energy etc.
2. To familiarize students with basic circuit components and their connections.
3. To explain working principle of transformer and electrical measuring instruments such as ammeter, voltmeter, wattmeter, energy meter, digital storage oscilloscope etc.

### **COURSE LEARNING OUTCOMES (CLOs)**

After completion of the course, students would be able to:

1. Verify fundamental laws like Ohm's Law, KCL, KVL, etc.
2. Understand the calibration of energy meter.
3. Understand open circuit and short circuit test of single-phase transformer.
4. Analyse RLC series and parallel circuits.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
C01	x	x		x
C02	x			x
C03	x	x	x	x

### **LIST OF EXPERIMENTS**

(A Student is supposed to complete/perform minimum **10** experiments)

1. To verify Kirchoff's voltage and Current Laws
2. To verify Superposition Theorem
3. To verify Thevenin's Theorem
4. To verify Maximum Power Transfer Theorem
5. To verify Norton's Theorem
6. To measure power and power factor in single phase AC circuit.
7. To verify Series and parallel RLC circuit
8. To conduct open circuit and short circuit test on a single-phase transformer
9. To perform Load test on single phase transformer
10. Calibration of Single Phase & Three Phase Energy Meter
11. To study Digital Storage Oscilloscope
12. To study the balanced three phase system for star and delta connected load
13. To study about earthing and their types.

### **TEXT BOOKS**

1. Handbook of Laboratory Experiments in Electronics and Electrical Engineering by A M Zungeru, J M Chuma, H U Ezea
2. Electrical Measurements & Measuring Instruments by E.W. Golding & F.C. Widdis
3. Electronic Measurement & Instrumentation by H.S. Kalsi
4. Electrical & Electronic Measurement & Instrumentation by A.K. Sawhney ,E. Fitzgerald, C.

- Kingsley and S. Umans, Electric Machinery, McGraw-Hill Co. Inc.
5. D. P. Kothari and I. J. Nagrath, Electrical Machines, Tata McGraw-Hill.

### **REFERENCE BOOKS**

1. M.G. Say, Alternating Current Machines, Pitman Publishing.
2. Alexander S. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw-Hill.

<b>BASIC ELECTRONICS ENGINEERING</b>	
<b>Course Code: 25EC101/25EC202</b>	<b>Continuous Evaluation: 40 Marks</b>
<b>Credits: 3</b>	<b>End Semester Examination: 60 Marks</b>
<b>L T P : 3 0 0</b>	
<b>Prerequisite: Nil</b>	

### **COURSE OBJECTIVES (COs)**

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

1. Analyse the characteristics and applications of semiconductor diodes, including Zener diodes, and their role in power supply and wave-shaping circuits.
2. Understand the operation, biasing, and characteristics of BJT, and apply them in amplification and switching circuits.
3. Understand the operation, biasing, and characteristics of FETs, and apply them in amplification and switching circuits
4. Design and implement analog circuits using op-amps for integration, differentiation, and signal conditioning applications.
5. Understand and simplify digital logic expressions using Boolean algebra, and design combinational digital circuits.

### **COURSE LEARNING OUTCOMES (CLOs)**

After completion of the course, students would be able to:

1. Understand and analyze the operation and characteristics of semiconductor diodes and their applications in rectifiers, clippers, and voltage regulators.
2. Demonstrate and evaluate the working principles, biasing, and applications of BJTs in switching and amplifier circuits.
3. Design and simulate analog electronic circuits using FET and Op-amps for real-time signal processing.
4. Comprehend and apply the fundamental concepts of digital logic, Boolean algebra, and combinational circuits.
5. Interpret electronic component datasheets, test devices using multimeters, and troubleshoot circuits effectively.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<b>DIODE THEORY AND APPLICATIONS:</b> Overview of p-n junction diode structure, Basic idea of forward and reverse biasing in diodes, VI characteristics of p-n junction diode under various biasing conditions, Ideal diode characteristics and assumptions, Second approximation (with cut-in voltage), Third approximation (including forward resistance and reverse leakage current), Structure and	9

	working principle of Zener diode, VI characteristics of Zener diode in breakdown region, Zener diode as a voltage regulator, half and Full Wave Rectifier: Circuit diagram, operation, and waveform analysis, Calculation of average and RMS output voltage, Ripple factor and efficiency, Transformer requirements and peak inverse voltage (PIV) analysis. <b>Wave Shaping Circuits:</b> Clipping Circuits, Clamping Circuits.	
<b>UNIT-II</b>	<b>BIPOLAR JUNCTION TRANSISTORS AND ITS BIASING:</b> BJT structure and working principle (NPN/PNP), CE, CB, and CC configurations: input/output characteristics and applications, BJT current and voltage relations, Switching operation of BJT: cutoff, active, and saturation regions, DC load line: operating point (Q-point) determination, Biasing methods: base bias, emitter feedback bias, collector feedback bias, voltage divider bias, Thermal runaway and stability factor	9
<b>UNIT-III</b>	<b>FIELD EFFECT TRANSISTORS (FET) AND ITS BIASING:</b> Introduction to JFET: structure, operation, and characteristics, Comparison of BJT and FET: input impedance, noise, gain, power usage, JFET transfer and drain characteristics, pinch-off voltage, Biasing methods for JFET: self-bias, voltage-divider bias, current source bias, FET operation in ohmic and active regions, Introduction to MOSFETs: D-type and E-type structures and operation, MOSFET as a switch: operation, input/output characteristics, E-MOSFET biasing technique: self-bias, voltage-divider bias, current source bias	9
<b>UNIT-IV</b>	<b>OP-AMP: OP-AMP:</b> Ideal op-amp characteristics and internal block diagram, Op-amp equivalent circuit model, Comparator circuit using op-amp: zero crossing detector, Inverting and non-inverting op-amp configurations: gain expressions and phase relations, summing amplifier using op-amp (inverting and non-inverting), Differential amplifier, integrator and differentiator circuits: design and waveforms.	9
<b>UNIT-V</b>	<b>DIGITAL ELECTRONICS:</b> Number systems: Binary, Decimal, Octal, Hexadecimal and their conversions. Basic logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR – symbols, truth tables, logic expressions, Consensus theorem, Boolean algebra: laws, identities, and logic simplification, De Morgan's Theorems and duality principle, Transposition theorem, Consensus theorem, Universal gates and their use in implementing any logic function, Algebraic simplification using Boolean laws and Karnaugh Maps (K-Maps upto three variable), NAND and NOR based gate implementation techniques, Combinational circuits: Half adder and Full adder, Half Subtractor, Full Subtractor design and logic expressions,	9

### TEXT BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Digital Design by M. Morris Mano, 5th Edition, Pearson Publication, 2016
3. Floyd T.L., Buchla D.L., "Electronics Fundamentals: Circuits, Devices and Applications", 8th 2010 Edition
4. Stallings, W., "Computer Organization and Architecture", 5th Ed., 2001 Pearson Education

### REFERENCE BOOKS

1. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition

2. Muthu subramanian.R, Salivahanan. S, Muraleedharan. K. A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw - Hill, 1999.
3. Microelectronic Circuits by A. S. Sedra and Kenneth C. Smith 7th Edition, Oxford University, Press. 2017

<b>BASIC ELECTRONICS ENGINEERING LAB</b>	
<b>Course Code:</b> 25EC151/25EC252	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To understand semiconductor device Characteristics.
2. To design and evaluate rectifier circuits.
3. To characterize transistor and FET operation.
4. To design and test OP-AMP circuits.
5. To demonstrate digital logic design.

### **COURSE LEARNING OUTCOMES (CLOs)**

1. To analyze PN junction, Zener diodes, and their applications in circuits.
2. To construct and compare half-wave, full-wave, and bridge rectifiers with filters.
3. To investigate BJT (CB), JFET, and MOSFET configurations and their regions of operation.
4. To implement and verify analog circuits (voltage follower, inverting/summing amplifiers).
5. To build and validate combinational circuits (logic gates, adders) and Boolean theorems.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

### **LIST OF EXPERIMENTS**

1. To study and analyse the V-I characteristics of a PN junction diode in both forward and reverse bias conditions using Silicon and Germanium diodes.
2. To examine the V-I characteristics of a Zener diode in forward and reverse bias, and to observe the Zener breakdown phenomenon and its application in voltage regulation.
3. To study the output waveform of a half-wave rectifier with and without a filter capacitor, and to observe how the capacitor smooths the pulsating DC output by reducing ripple.
4. To analyse the characteristics of a full-wave centre-tapped rectifier, observe its output waveform, and evaluate the effect of filter capacitors of varying values on ripple reduction and waveform smoothness.
5. To construct and test a bridge rectifier circuit, monitor its output waveform, and investigate the improvement in waveform smoothness with the use of different filter capacitor values.
6. To study the input and output characteristics of a transistor in Common Base (CB) configuration.
7. To study the output characteristics of an N-channel JFET, and to observe the behavior of the JFET in ohmic and saturation regions.
8. To study the output characteristics of an N-channel MOSFET and to analyze the MOSFET's behavior in the ohmic and saturation regions.

9. To design and analyse a voltage follower circuit using an operational amplifier (OP-AMP) and verify that the output voltage exactly follows the input voltage with a unity gain ( $A=1$ ).
10. To design and verify the operation of an inverting amplifier using an OP-AMP, and to measure the output voltage for a given input voltage with a known gain, validating the relationship:  $V_o = -A \cdot V_i$ .
11. To design and verify the operation of a summing amplifier using an operational amplifier (OP-AMP) and to measure the output voltage for different input voltages, demonstrating linear summation with unity gain.
12. To design and verify the truth tables of basic logic gates (AND, OR, NAND, NOR, XOR, and XNOR) using digital ICs on a breadboard.
13. To experimentally **verify the Consensus Theorem** of Boolean algebra using logic gates and validate its application in simplifying digital circuits.
14. To design and verify the working of a **half adder circuit** using basic logic gates (AND and XOR).
15. To design and verify the working of a **full adder circuit** using basic logic gates (AND, OR and XOR).

**REFERENCE: LABORATORY MANUAL**

FUNDAMENTALS OF ROBOTICS & AI	
Course Code: 25ME101/25ME202	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

### COURSE OBJECTIVES (COs)

The objectives of this course are to:

1. Understand and discuss the fundamental elementary concepts of Robotics.
2. Provide insight into different types of robots.
3. Explain intelligent module for robotic motion control.
4. Educate on various path planning techniques.
5. Illustrate the working of innovative robotic devices

### COURSE LEARNING OUTCOMES (CLOs)

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

1. Describe the fundamental concepts, history, and components of robotics.
2. Classify various types of robots and analyze their configurations and kinematics.
3. Explain different drive systems, end effectors, and control methods used in robotic systems.
4. Evaluate applications of robotics in industrial, medical, agricultural, and autonomous systems.
5. Demonstrate a basic understanding of Artificial Intelligence concepts relevant to robotics.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02	✓				
C03		✓			
C04			✓		✓
C05				✓	

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
UNIT -I	<b>Introduction To Robotics:</b> Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.	9
UNIT -II	<b>Robot Anatomy And Motion Analysis:</b> Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.	9
UNIT -III	<b>Robot Drives and End Effectors:</b> Robot drive systems: Hydraulic, Pneumatic and Electric drive systems, classification of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper, gripper force analysis and gripper design, 1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors,	9

	Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.	
<b>UNIT -IV</b>	<b>Robotics Applications: Material Handling:</b> Pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots	9
<b>UNIT -V</b>	<b>Fundamentals of Artificial Intelligence:</b> Introduction to Artificial Intelligence: definition, goals, and brief history; basic concepts of AI: learning, reasoning, and problem-solving; knowledge representation and simple rule-based systems; overview of machine learning: supervised and unsupervised learning; role of AI in enabling intelligent behavior in robots.	9

### TEXT BOOKS

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.
2. Mikell P. Groover et al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).
3. Ganesh S Hegde, "A textbook on Industrial Robotics", University science press, 3rd edition, 2017.
4. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
5. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, 1987. <https://www.robots.com/applications>.

<b>DESIGN THINKING AND ENGINEERING PRACTICES LAB</b>	
<b>Course Code:</b> 25ME151/25ME252	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To introduce students to the fundamentals of design thinking and its application in engineering problem-solving.
2. To understand workshop tools used in carpentry, welding, sheet metal, and machining
3. To provide hands-on experience in basic engineering practices such as welding, carpentry, machining, and sheet metal work.
4. To foster creativity, teamwork, and practical skills through physical prototyping.
5. To understand safety, tools, and standard practices involved in common engineering operations.

### **COURSE LEARNING OUTCOMES (CLOs)**

Upon successful completion of the course the students will be able to

1. Apply design thinking principles to simple engineering problems
2. Operate basic workshop tools used in carpentry, welding, sheet metal, and machining
3. Demonstrate hands-on skills through the fabrication of simple mechanical components
4. Work effectively as a team member in engineering practice sessions
5. Apply workshop safety protocols and proper tool handling procedures

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

### **LIST OF EXPERIMENTS**

1. Introduction to Design Thinking: Empathize, Define, Ideate, Prototype, Test – with engineering case examples
2. Safety and Workshop Orientation: Personal Protective Equipment (PPE), safety signs, hazard zones, and tool use policies
3. Carpentry Practice: Sawing, chiselling, planning, drilling – make a dovetail or T-joint
4. Welding Practice: Arc welding (butt & lap joints), electrode selection, safety protocols
5. Sheet Metal Work: Cutting, bending, rivet joining, tray/box making
6. Machining Practice: Lathe operation (facing, turning), drilling, tapping
7. Mini Project (Design + Fabrication): Students form teams to design and fabricate a small product using at least 2 workshop processes
8. Presentation & Evaluation: Final demonstration of project, reflection on design thinking, peer review

### **TEXT BOOKS**

1. **K.C. John**“Mechanical Workshop Practice”, PHI Learning Pvt. Ltd., Latest Edition. Covers carpentry, welding, fitting, machining, and safety practices.
2. **Sanjay Moizuddi**“Introduction to Design Thinking”, Pearson Education, 1st Edition. Introduces the design thinking process with real-world applications in engineering.

3. **Raghavendra, K. and Krishnamurthy, L.**“Engineering Workshop Practice”, PHI Learning Pvt. Ltd.  
A practical reference for workshop tools and exercises (wood, metal, welding).
4. **P. Kannaiah& K.L. Narayana**“Workshop Manual”, Scitech Publications.  
Detailed procedural steps for carpentry, sheet metal, fitting, and machining.
5. **IDEO.org**“The Field Guide to Human-Centered Design”, IDEO Press (Free PDF available online)  
A hands-on reference for applying empathy, prototyping, and iteration in design thinking.
6. **Tapan P. Bagchi**“Engineering Design”, Wiley India Pvt. Ltd.  
Explores the fundamentals of creative problem-solving and product design.

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b>	
<b>Course Code:</b> 25CS101/25CS202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 3	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 3 0 0	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To familiarize and understand the basic concepts of digital computers and computer programming.
2. To impart adequate knowledge on the need of programming languages and problem solving techniques.
3. To analyze and construct effective algorithms.
4. To develop problem solving ability using programming.
5. To employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental concepts of computers, both hardware and software.
2. Learn and understand the major system software that help in developing an application.
3. Apply and analyse the basic programming constructs in context of C programming language.
4. Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions
5. Create and manipulate a database or data storage through files.
6. Learn a programming approach to solve problems.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO 5</b>	<b>CLO 6</b>
C01	x	x				
C02		x	x			
C03			x	x		
C04					x	
C05						x

**MAPPED SDGs: SDG-4, SDG-9**

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT -I</b>	<b>INTRODUCTION OF COMPUTER SYSTEM</b> Anatomy of a digital Computer, Different Units of Computer, System, Hardware & Software, Classification of Computer Systems, Number systems, Operating System: Definition, working & its functions, Basic concepts of Computer Networks, Network Topologies.	9
<b>UNIT -II</b>	<b>INTRODUCTION TO SYSTEM SOFTWARE</b> Programming language- Definition, types; Syntax & Semantics, Type of programming errors, Assembler, Linker, Loader, Compiler,	9

	Interpreter, debuggers, Algorithms, flowcharts and their symbols.	
<b>UNIT -III</b>	<b>BASICS OF 'C' LANGUAGE</b> C Fundamentals, Basic data types, variables and scope, storage classes, operators and expressions, formatted input/ output, expressions, selection statements, loops and their applications.	9
<b>UNIT -IV</b>	<b>ARRAY &amp; FUNCTION</b> Arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications. Storage Classes and Pre-processor Directives.	9
<b>UNIT -V</b>	<b>STRUCTURE &amp; FILE SYSTEM</b> Structures, declaring a Structure, Accessing Structure Elements, Storing Structure elements, Array of Structures, Unions and Enumerations, Dynamic memory allocation. File Input/Output, Data Organization, File Operations, opening a File, reading from a File, Closing the File, Writing to a File, File Opening Modes.	9

### TEXT BOOKS

1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
3. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2014, New Delhi.
4. Let Us C, YashwantKanetkar, 20th Edition, BPB Publications, 2024.
5. Computer Fundamentals and Programming in C, ReemaTheraja, 2<sup>nd</sup> Edition, Oxford, 2016.

### OPEN EDUCATIONAL RESOURCES

1. **Programming in C:** [https://en.wikibooks.org/wiki/C\\_Programming](https://en.wikibooks.org/wiki/C_Programming)
2. **C Programming and Data Structures:** <https://nptel.ac.in/courses/106/105/106105171/>
3. **Harvard's CS50 (Introduction to Computer Science):** <https://cs50.harvard.edu/x/>

### REFERENCE BOOKS

1. Information technology, Dennis P. Curtin, Kim Foley, KunalSen, Cathleen Morin, 1998, TMH.
2. Theory and problem of programming with C, Byron C Gottfried, TMH.

<b>C PROGRAMMING LAB</b>	
<b>Course Code:</b> 25CS151/25CS252	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To develop problem solving ability using programming.
2. To impart adequate knowledge on the need of programming languages and problem-solving techniques.
3. To develop a methodological way of problem solving.
4. To learn a programming approach to solve problems.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.
2. Introduction to C Programming using Control Statements and Repetition Statement.
3. Apply and practice logical formulations to solve some simple problems leading to specific applications.
4. Design effectively the required programming components that efficiently solve computing problems in the real world.
5. Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
CO1	√				
CO2		√	√		
CO3				√	
CO4					√

**MAPPED SDGs: SDG-4, SDG-9**

### **LIST OF EXPERIMENTS**

1. Implement a C program to determine the largest of three numbers using the if-else construct
2. Implement a program to find the largest among ten numbers using for-statement.
3. Design a program to compute average height by gender based on inputs of sex code and height.
4. Implement a function-based program to find the roots of a quadratic equation using a **switch-case** construct.
5. Implement logic to find the largest and second largest in an array of 50 integers.
6. Implement matrix multiplication using nested loops and two-dimensional array.
7. Implement a sorting algorithm to arrange a list of numbers in ascending order.

8. Develop an ATM simulation system that supports balance, deposit, withdraw options using switch-case.
9. Implement a recursive program to generate Fibonacci series.
10. Implement a program to swap two numbers using both call by value and call by reference.
11. Implement string operations to check whether a given string is a palindrome.
12. Develop a structure-based program to manage student records with add, view, and update functionality.
13. Implement file handling operations to create a file and write user input to it.
14. Write a program which manipulates structures into files (write, read, and update records).
15. Mini Project –Write a program to develop a small application using functions, arrays, structures, and file handling. Choose one of the following:
  - i) Student Record Management System
  - ii) Quiz Game
  - iii) Hospital Patient Entry System
  - iv) Railway Reservation System

### **TEXT BOOKS**

1. C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 2nd Edition, Pearson.
2. Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
3. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.

### **REFERENCE BOOKS**

1. Let Us C, Yashwant Kanetkar, 20th Edition, BPB Publications.
2. Computer Fundamentals and Programming in C, Reema Theraja, Oxford
3. Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.

### **OPEN EDUCATIONAL RESOURCES**

1. MIT Open Course ware: [https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/resources/mit6\\_087iap10\\_lec01/](https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/resources/mit6_087iap10_lec01/)

<b>COMMUNICATIVE ENGLISH</b>	
<b>Course Code:</b> 25HS101/25HS202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> Basic Knowledge of English	

### **COURSE OBJECTIVES (COs)**

1. To prepare the students for their career which will require them to listen, read, speak, and write in English both for their professional as well as interpersonal communication
2. To write clear, coherent, and well-organized texts, such as emails, essays, reports, and other forms of written communication.
3. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.
4. To enhance student's ability to understand spoken English in various contexts, including conversations, lectures, and media.
5. To enhance student's vocabulary and master key grammatical structures, enabling them to communicate more effectively and accurately.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Recall and identify English vocabulary words and grammatical structures.
2. Analyse the structure and organization of written texts, identifying the introduction, body, and conclusion.
3. Examine how the use of specific language techniques impacts the effectiveness of communication.
4. Assess and critique public speeches and presentations based on clarity, coherence, and persuasiveness.
5. Evaluate one's own language skills and identify areas for improvement.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO 5
C01	✓	✓	✓		
C02		✓		✓	
C03			✓		
C04				✓	✓
C05					✓

### **COURSE CONTENTS**

UNIT	COURSE CONTENTS	HOURS
<b>UNIT -I</b>	<b>Introduction to Communication</b> Elements and Process of Communication, Types and Barriers to Communications, Grice Conversational Maxims and Cooperative Principles, Verbal and non-verbal communication, Body Language: Proxemics, Chronemics, and Haptics, Identifying and rectifying common errors: Types of Sentences (Statements, interrogative, exclamatory, Optative, and imperative, Wh/How-questions, question-tags), Basic Grammar: - Articles, Prepositions, Cliches,	<b>6</b>

	Collocations, and Punctuations, Case studies based on Communication Skills <a href="https://pressbooks.bccampus.ca/technicalwriting/chapter/casestudy-costpoorcommunication/">https://pressbooks.bccampus.ca/technicalwriting/chapter/casestudy-costpoorcommunication/</a>	
<b>UNIT -II</b>	<b>Workplace Communication</b> Communication Challenges in a Culturally Diverse Workplace; Ethics in Communication, Bias-free communication, Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; and PowerPoint Presentation, Case Studies based on communication challenges in the workplace	<b>6</b>
<b>UNIT -III</b>	<b>Effective Writing</b> Paragraph Writing: Topic Sentence, Guided composition, Free-writing, Reading comprehension practice: Technical and General text, use of different techniques (skimming and scanning), Selection of Words; Coherence and Cohesion, Use of discourse markers concerning technical writing, Case Studies based on technical writing skills	<b>6</b>
<b>UNIT -IV</b>	<b>Business Writing at Work</b> Cover Letters and Applications, Writing notices and circulars, Email Writing and Memorandum, Writing reports	<b>6</b>

### TEXTBOOKS

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4<sup>th</sup> Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene, and Mala Sinha. Cengage Learning. 2<sup>nd</sup> Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [Macmillan]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

COMMUNICATIVE ENGLISH LAB	
Course Code: 25HS151/25HS252	Continuous Evaluation:60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Basic Knowledge of English	

### COURSE OBJECTIVES (COs)

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication
2. To empower the students to improve both abilities to communicate and their linguistic
3. To increase their competence and boost their confidence.
4. To enable the students to properly communicate and express themselves in writing.
5. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Summarize conversations, demonstrating understanding of the content.
2. Apply communication strategies to maintain conversations and express ideas clearly.
3. Critique and assess various spoken interactions to identify strengths and areas for improvement in communication.
4. Create engaging dialogues or role-plays that demonstrate real-life communicative scenarios.
5. Develop and present persuasive arguments or opinions on various topics in English.

### MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OBJECTIVES (CLOs)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO 5
CO1	✓	✓	✓		
CO2		✓		✓	
CO3			✓	✓	
CO4				✓	
CO5					✓

### LIST OF ACTIVITIES

UNIT	COURSE CONTENTS	HOURS
UNIT -I	<ul style="list-style-type: none"> <li>• Listening and Speaking</li> <li>• Accent in speech (British and American)</li> <li>• Practicing Sounds of English: Stress and Intonation Patterns</li> </ul>	4
UNIT -II	<ul style="list-style-type: none"> <li>• Role-play</li> <li>• Extempore</li> </ul>	4

	<ul style="list-style-type: none"> <li>• JAM (Just a minute)</li> </ul>	
<b>UNIT -III</b>	<ul style="list-style-type: none"> <li>• Presentations</li> <li>• Interview Simulations</li> <li>• Telephone Etiquettes</li> </ul>	4
<b>UNIT -IV</b>	<ul style="list-style-type: none"> <li>• Formal speech- Welcome Speech and Vote of thanks</li> <li>• Public Speaking and Rhetoric</li> <li>• Group Discussions and Debates</li> </ul>	4

### **TEXT BOOKS**

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [MACMILLAN]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

### **REFERENCE BOOKS**

1. Technical Communication, Principle and Practice by Meenakshi Raman &Sangeeta Sharma, Oxford University Press.
2. Communication skill by Sanjay Kumar &PuspaLata, Oxford University Press. 2nd Edition.
3. Business Communication Today by Courtland L Bovee and Thill, Pearson

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB</b>	
<b>Course Code:</b> 25ME153/25ME254	<b>Continuous Evaluation:</b> 60 Marks
<b>Credits:</b> 1	<b>End Semester Examination:</b> 40 Marks
<b>L T P :</b> 0 0 2	
<b>Prerequisite:</b> NIL	

### **COURSE OBJECTIVES (COs)**

1. To draw orthographic projections of lines, planes and solids.
2. To construct isometric scale, isometric projections and views.
3. To draw sections of solids including cylinders, cones, prisms and pyramids.
4. To draw projections of lines, planes, solids, isometric projections

### **COURSE LEARNING OUTCOMES (CLOs)**

Once the course is completed, the students will be able to

1. Understand orthographic projections of points and lines in any position through Auto CAD.
2. Imagine and convert isometric views into orthographic projections and vice versa.
3. Understand the simple machine components and draw its projections

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>
C01	√		
C02		√	
C03			√
C04			√

### **LIST OF EXPERIMENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<b>INTRODUCTION TO ENGINEERING GRAPHICS AND AUTOCAD</b> Principles of Engineering Graphics and its significance - Usage of drawing instruments -Lettering and Dimensioning Standards - The concepts of Computer Aided Drafting for Engineering Drawing - Introduction to AutoCAD software - AutoCAD commands, tools and its usage - Geometrical Constructions	3
<b>UNIT-II</b>	<b>ORTHOGRAPHIC PROJECTIONS</b> Orthographic Projections - First angle projections - Visualization concepts and principles - Layout of views - Conversion of pictorial diagram into orthographic projections	3
<b>UNIT-III</b>	<b>PROJECTION OF PLANES AND SOLIDS</b> Projections of Planes (polygonal and circular surfaces) inclined to the HP only - Projection of simple solids like Prisms, Pyramids, Cylinders, and Cones (Axis inclined to the HP only) by change of position method.	3
<b>UNIT-IV</b>	<b>SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES</b>	3

	Sectioning of Simple solids in a simple vertical position using a cutting plane inclined to the HP only, and obtaining the true shape of the section - Development of the lateral surfaces of simple solids like Prisms, Pyramids, Cylinders, and Cones.	
<b>UNIT-V</b>	<b>ISOMETRIC PROJECTIONS AND CAD APPLICATIONS</b> Principles of Isometric projections - Isometric scale and view - Isometric view of simple solids (Prisms, Pyramids, Cylinders, and Cones) - Combination of two solids in simple vertical positions - Applications of CAD software in drafting real-world scenarios.	3

**TEXT BOOKS:**

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing S. Trymbaka Murthy, 4th Ed, University Press
3. Engineering Drawing by N. S. Parthasarathy and Vela Murali Oxford University Press

**REFERENCE BOOKS:**

1. Engineering Graphics - K.R. Gopala krishna, Subash Publishers Bangalore.
2. Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, Prentice-Hall of India Pvt. Ltd.,New Delhi.
3. Computer Aided Engineering drawing, Prof. M. H. Annaiah, New Age International Publisher

<b>HINDI -I</b>	
<b>Course Code:</b> 25HIN101/25HIN202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

हिन्दी विषय के प्रश्नपत्र की सामग्री में ज्ञान तथा शिक्षा के बदलते परिदृश्य को ध्यान में रखा गया है। हिन्दी के भक्तिकाल, रीतिकाल और आधुनिककाल के कवियों की कविताओं को पाठ्यक्रम में शामिल किया है। व्याकरण की विभिन्न कोटियों तथा भाषा के सम्प्रेषण से हिन्दी का प्रचार-प्रसार होगा। संचार कौशल के द्वारा छात्रों का ज्ञान परिमार्जित होगा। साहित्येतर छात्रों के ज्ञानवर्धन, भाषायीक्षमता एवम् अभिवृद्धि भी इस पाठ्यक्रम का लक्ष्य है।

### **COURSE LEARNING OUTCOMES (CLOs)**

पाठ्यक्रमपरिणाम

#### **1. Knowledge Outcome**

ज्ञानकापरिणाम

**At the end of the course, the student should be able to**

पाठ्यक्रम केअंत में छात्र सक्षम होना चाहिए

1. -हिन्दी के प्रमुख कवि जो पाठ्यक्रम में शामिल हैं, उनकी कविताओं की व्याख्या और काव्यगत विशेषताओं को छात्र समझेंगे।
2. छात्रों को काव्य में रस, अलंकार और छन्द का ज्ञान प्राप्त होगा।
3. -व्याकरण के अध्ययन से छात्रों को भाषा बोलने, लिखने और पढने में सहायता प्राप्त होगी।

#### **2. Skill Outcome**

कौशल का परिणाम

**At the end of the course, the student should be able to**

पाठ्यक्रम केअंत में छात्रसक्षम होना चाहिए

1. -हिन्दी कवियों व उनकी कविताओं से परिचित हो जाएंगे।
2. छात्र दोहे और कविता समझने में सक्षम होंगे।
3. -व्याकरण के ज्ञान के साथ-साथ शब्दों के उच्चारण के बोध से अवगत होंगे।

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	इस इकाई में हिंदी भक्तिकाल के प्रमुख कविकबीरदास हैं। कबीरदास- कबीरदास के दोहे 5 दोहे	8
<b>UNIT-II</b>	इस इकाई में हिंदी रीतिकाल के प्रमुख कवि बिहारीलाल हैं। बिहारीलाल- बिहारीलाल के दोहे 5दोहे	7
<b>UNIT-III</b>	इस इकाई में हिंदी आधुनिककाल के प्रमुख कवि माखनलाल चतुर्वेदी हैं। माखनलाल चतुर्वेदी ( पृष्पकीअभिलाषा (कविता	7
<b>UNIT-IV</b>	यह इकाई संचार कौशल से सम्बन्धित है. इसमें (i)हिंदी के प्रमुख मुहावरे और लोकोक्तियाँ (ii) आत्मपरिचय (self-introduction), साक्षात्कारकौशल (interview skills), कार्यक्रमसंचालन/मंचप्रबंधन (event management)	8

### **METHODOLOGY पद्धति**

- कक्षाव्याख्यान
- व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा।
- समय-समय पर छात्रों को प्रदत्तकार्य दिया जाएगा।
- साप्ताहिकप्रश्नावली।

### **REFERENCE BOOKS/ TEXT BOOKS**

आवश्यक पुस्तकें और सामग्री

1. -कबीरग्रन्थावली, संपादक-श्यामसुन्दरदास, काशीनागरी प्रचारिणी सभा ।
2. बिहारीसतसई, साहित्यसंस्थान प्रयाग।
3. -भाषाविज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद ।
4. -हिंदीव्याकरण, कामताप्रसादगुरु, प्रभातप्रकाशनदिल्ली

GERMAN-I	
Course Code:25FLGR101	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: Basics of English Language	

### COURSE OBJECTIVES (COs)

The objective of this course is to impart basic knowledge of German language to the students. The course intends to grow the ability of verbal and written communication. Overall, the objective is to facilitate comprehension of daily life contexts in German, both oral as well as written.

1. To develop oral and written skills of understanding, expressing and exchanging information in German language.
2. To develop awareness of the nature of language and language learning.
3. To develop the ability to construct sentences and frame questions.
4. To provide German language as a competitive edge in career choices.
5. To know some of the aspects of the culture of the countries where German language is spoken.

### COURSE LEARNING OUTCOMES (CLOs)

After completion of the course the students will have the ability to:

1. Read and write short, simple texts.
2. Understand and take part in short, simple conversations using the skills acquired.
3. Know some aspects of the culture of the countries where the German language is spoken.
4. Read a text and/or e-mail during any employment.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4
CO1	√	√		
CO2	√			
CO3		√		
CO4				√
CO5			√	

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
UNIT-I	- Informationen über Deutschland - Buchstaben, die Aussprache, Wochentage, Monate - Begrüßung, Wie geht's? , sich vorstellen, Zahlen, W-Familie	8
UNIT-II	- Über Personen sprechen (Name, Herkunft, Adresse, Telefonnummer, Alter, Beruf, Familie), - Länder und Sprachen, Berufe, Satzstruktur, Familienmitglieder, Farben, Wetter - Personalpronomen, Konjugation von Verben (sein, haben, heißen, wohnen, kommen, machen, lernen, arbeiten, studieren)	8
UNIT-III	- Nomen (Genus, Singular-Plural), Bestimmter Artikel, Unbestimmter Artikel, Negation, W-Frage, Ja-Nein-Frage	

	<ul style="list-style-type: none"> <li>- Über Sachen sprechen</li> <li>- Sachen des Alltagslebens (Obst und Gemüse, Schulsachen), Haushaltswaren, Adjektive</li> </ul>	7
<b>UNIT-IV</b>	<ul style="list-style-type: none"> <li>- Akkusativ, Artikel und Personalpronomen im Akkusativ</li> <li>- Unregelmäßige Verben</li> <li>- Kleidung, Lebensmittel</li> </ul> <p>Leseverstehen.</p>	8

### **TEXT BOOKS**

1. Netzwerk Neu A1 (Kursbuch+Arbeitsbuch) by Stefanie Dengler, et al. Ernst Klett Sprachen, 2019.

### **OPEN EDUCATIONAL RESOURCES**

2. **Website for additional materials:** <https://www.nthuleen.com/teach.html>

### **REFERENCE BOOKS**

1. Studio D A1, Hermann Funk, Christina Kuhn, Silke Demme, 2010, Cornelsen.
2. Einfach Grammatik: Übungsgrammatik Deutsch A1 bis B1, Paul Rusch, Helen Schmitz, 2012, Langenscheidt.
3. Berliner Platz - neu: Lehr- und Arbeitsbuch, Christiane Lemcke, Lutz Rohrmann, Theo Scherling, 2009, Klett Sprachen.
4. Tangram aktuell 1: A1, Rosa-Maria Dallapiazza, Eduard von Jan, Sabine Dinsel, 1998, Hueber Verlag.
5. Lernziel Deutsch: Deutsch als Fremdsprache, Teil 1, Wolfgang Hieber, 1984, Max Hueber Verlag

<b>FRENCH-1</b>	
Course Code: 25FLFR101	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> Basics of English Language	

### **COURSE OBJECTIVES (COs)**

1. To develop the skills to construct short and simple sentences.
2. To prepare the students to identify themselves with the culture of the Francophone world.
3. To develop in students a good degree of understanding of syntactic, lexical, grammatical and stylistic features of the French language.
4. To demonstrate differences and diversity of the French speaking world with their own

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of the course, students would be able to:

1. Speak themselves in French used in daily conversations.
2. Explain cultural artefacts, practices and perspectives of the French speaking world.
3. Apply linguistic knowledge to analyse a simple text, identifying its salient features, and thus express themselves effectively in French.
4. Contrast culture of the French speaking world with their own, and hence demonstrate an increased awareness towards its key practices and perspectives.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
CO1	√		√	
CO2		√		√
CO3			√	
CO4				√

### **COURSE CONTENTS**

<b>UNIT</b>	<b>Unités</b>	<b>Objectifs de Communication</b>	<b>Grammaire</b>	<b>Lexique</b>	<b>Heures</b>
<b>UNIT-I</b>	<b>La Salutation et l'Introduction</b>	Saluer. Entrer en Contact. S'Excuser. Remercier. Se Présenter/Présenter Quelqu'un.	Pronoms Personnels Sujets. L'Alphabet. Les Articles Indéfinis. Les Verbes en -ER au Présent.	Salutations, Les Nombres. Les Objets de la Classe. La Nationalité.	8

<b>UNIT-I I</b>	<b>On Partage des Renseignements</b>	Demander de Se Présenter. Donner des Renseignements Personnels.	Etre et Avoir au Présent. Les Verbes en -ER au Présent. Adjectifs de Nationalités. L'Interrogation.	Adjectifs de Nationalité, Métiers et Secteurs Professionnels, Goûts et Intérêts	8
<b>UNIT-I II</b>	<b>Ma Ville et Mon Quartier</b>	Décrire et Qualifier Ville ou Quartier. Localiser. Demander et Donner Directions.	Verbe Vivre. Articles Définis (Le, la, les). Il y a/ Il n'y a pas. Prépositions. Adjectifs Qualificatifs. Impératif.	Prépositions de lieux. Vocabulaire des Sites. Etablissements et Service de Ville.	7
<b>UNIT-I V</b>	<b>Mes Intérêts et Goûts</b>	Parler de Ses Goûts et de Ses Loisirs. Donner Son Impression sur le Caractère de Quelqu'un.	Présent des Verbes en -ER, et du Verbe Faire. Négation, Adjectifs Possessifs.	Avoir l'air. Loisirs. L'Expression des Goûts. Faire du/ de la. Ma Famille.	7

## TEXT BOOKS

1. Version Originale 1, Livre de l'élève: Denyer M. & Agustin GarmendiaA. & Olivieri M L L., éd. Maisons des Langues, Paris. 2013.

## REFERENCE BOOKS

1. Alter Ego 1, Livre d'élève, Berthet A. & Hugo C. & Kizirian M. V. & Sampsonis B. & Waendendries M., éd Hachette, Paris, 2006.
2. Connexions 1, Loiseau Y. & Mérieux R., éd. Didier, Paris, 2004.
3. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, CLE International, Paris, 2013.  
Le Robert & Nathan Conjugation, Paperback, Le Robert Nathan

<b>ENVIRONMENTAL BIOENGINEERING</b>	
<b>Course Code:</b> 25ESEB101/25ESEB202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 3	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 3 0 0	
<b>Prerequisite:</b> Nil	

**Course Objectives (COs)** - The Course is designed with the following objectives:

1. To provide a comprehensive understanding of the relationship between humans and the environment.
2. Aims to introduce students to the different components of the environment.
3. To develop the understanding of pollution, its causes, and their effects
4. To familiarize the students with the different biological concepts. Including artificial intelligence and its applications.

**Course Learning Outcomes (CLOs)** -The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

1. Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
2. Demonstrate to safeguard the Earth's environment and its resources.
3. Explain sustainable development, its goals, challenges, and global strategies.
4. Improve biological concepts using an engineering approach.

#### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
C01	√			
C02		√		
C03			√	
C04				√

#### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<b>Human and Environment</b> Introduction to earth environment, Scope and importance. Components of the environment: Lithosphere, Hydrosphere, Biosphere, Atmosphere. The man-environment interaction, Population growth and natural resource exploitation, Industrial revolution, and its impact on the environment. Understanding of pollutant and pollution; Types of Pollution, Air pollution: Water pollution, Soil pollution and solid waste, Noise pollution, Thermal pollution and their impact on human health.	<b>8</b>
<b>UNIT-II</b>	<b>Natural Resources, Sustainable Development &amp; Sustainable living</b> Overview of natural resources, Classification of natural resources, Resources: Forests, wetlands, Status and challenges. Water resources: Types of water resources,	<b>8</b>

	issues and challenges; Soil and mineral resources, Energy resources: renewable and non-renewable sources of energy. Biodiversity and its distribution, Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Introduction to sustainable development: Sustainable Development Goals (SDGs)-targets and indicators, challenges, and strategies for SDGs. Ways to live in sustainable manner- Conservation of energy, water at home, plantation, waste segregation, kitchen gardening.	
<b>UNIT-III</b>	<b>Introduction of Bioengineering:</b> Significance of biology, fundamental similarities, and differences between science and engineering- humans as the best machines, brain as a computer, comparison between eye camera, <b>Biomolecules:</b> molecules of the life –monomeric unit and polymeric structure, carbohydrates, proteins; nucleotides and lipids. Bio-engineering introduction and current status in Agriculture, Medicine (vaccine and biosensors) enzyme technology, and environment, and the role of artificial intelligence and robotics in human health monitoring.	7
<b>UNIT-IV</b>	<b>Bioengineering in Environment Protection:</b> What is environmental bioengineering? Applications of bioengineering in the environment Protection. Global environmental problems and bioengineering approaches for their management. Sewage treatment, bio fertilizers, biofuels, bioreactors, bioremediation, and bioengineering for biomedical waste management. Role of artificial intelligence in handling biomedical waste	7

#### TEXT BOOKS:

1. Masters, G. M., &Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
2. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
3. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
4. Environmental Studies for Undergraduate Courses by ErachBharucha, UGC New Delhi
5. Biology: a Gopal approach Campbell, N.A Reece, J.B Urry, Lisa; Cain M.L Wasserman, S.A Minorsky, P. V Jackson, R. B Person Education ltd.

#### REFERENCE BOOKS:

1. A.K De Environmental Chemistry New age Publisher, 2016.
2. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
3. www.ipcc.org; <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
4. Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards>.
5. Principles of Biochemistry (V Edition) by Nelson, D.L; and Cox, M. M. W. H Freeman and company.

<b>INDIAN CONSTITUTION &amp; POLITY</b>	
<b>Course Code:</b> 25VAC101/25VAC202	<b>Continuous Evaluation:</b> 30 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 70 Marks
<b>L T P :</b> 3 0 0	
<b>Prerequisite:</b> Nil	

### **COURSE OBJECTIVES (COs)**

1. To acquaint the students with the fundamental concepts of democracy, diversity and the Constitution.
2. To make students understand the functioning of the three wings of the State
3. To make the students appreciate the purpose of decentralised administration under the Constitution and its functioning
4. To make students analyse and discuss various rights and duties under the Constitution of India

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the concept of democracy, diversity and the Constitutional Values
2. Describe the functioning of the three wings of the State
3. Sketch the functioning of decentralised administration under the Constitution of India and appreciate the political dimensions.
4. Examine the scope of various rights and duties under the Constitution of India.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO 1</b>	<b>CLO 2</b>	<b>CLO 3</b>	<b>CLO 4</b>
CO1	x	x	x	
CO2		x		x
CO3			x	x
CO4				x

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<b>DEMOCRACY, DIVERSITY AND THE CONSTITUTION:</b> <ul style="list-style-type: none"> <li>● Concept of democracy and importance of right to vote</li> <li>● Electoral Politics</li> <li>● Concepts of diversity and discrimination on the grounds of gender, religion and caste</li> <li>● Concept of democratic government</li> <li>● Constitution design and salient features</li> <li>● Preamble to the Constitution of India</li> </ul>	<b>8</b>
<b>UNIT-II</b>	<b>THE THREE WINGS OF THE STATE :</b> <ul style="list-style-type: none"> <li>● The definition of State in Constitution of India</li> <li>● Parliament, the State legislature and the making of laws</li> </ul>	<b>8</b>

	<ul style="list-style-type: none"> <li>● Concept of cooperative federalism</li> <li>● The Executive and Administration</li> <li>● Role of Governor and the President of India</li> <li>● The Judiciary</li> </ul>	
<b>UNIT-III</b>	<b>LOCAL GOVERNMENT AND ADMINISTRATION:</b> <ul style="list-style-type: none"> <li>● Panchayati Raj System</li> <li>● Rural and Urban administration</li> <li>● Social and Economic Justice for the marginalized</li> <li>● Directive Principles of State Policy</li> </ul>	<b>7</b>
<b>UNIT-IV</b>	<b>RIGHTS AND DUTIES:</b> <ul style="list-style-type: none"> <li>● Fundamental Rights (Part III of the Constitution)</li> <li>● Protection of Fundamental Rights – Writ petitions in High Court and Supreme Court of India</li> <li>● Fundamental Duties</li> <li>● The concept of Fraternity and secularism</li> <li>● Public utilities and privatization</li> </ul>	<b>7</b>

**RECOMMENDED TEXT BOOKS:**

1. D.D. Basu, Introduction to the Constitution of India, (LexisNexis, 26<sup>th</sup> Ed., 2022).
2. M. Laxmikant, Indian Polity(McGraw Hill, 7<sup>th</sup> Ed., 2023)
3. Subhash C. Kashyap, Constitution of India (Vitasta Publishing Pvt. Ltd, 1<sup>st</sup> Ed., 2019)

**REFERENCE BOOKS:**

1. M.P. Jain, Indian Constitutional Law (Lexis Nexis, 8<sup>th</sup> Ed., 2018).
2. H.M. Seervai, Constitutional Law of India (Law & Justice 4<sup>th</sup> Ed., 2023)
3. P.M. Bakshi, The Constitution of India, (Universal Law Publishing Co.,18<sup>th</sup> Ed., 2022)
4. J.N.Pandey, Constitutional Law of India(Central Law Agency, 59<sup>th</sup> Ed.,2022, Allahabad

## SEMESTER II

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:25AS202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60Marks
L T P : 3 1 0	
Prerequisite: Engineering Mathematics-I	

### COURSE OBJECTIVES (COs):

1. To enable students to have skills that will help them to solve real-world problems based on different types of differential equations.
2. To explain basics of vector spaces and linear transformations.
3. To describe Laplace and inverse Laplace transforms with their properties.
4. To understand Analytic functions, Construction of Analytic Functions
5. To equip the students with the concept of Complex Integration, Taylor's and Laurent's Expansions, Residues and Singularities.

### COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Interpret various physical models through higher order differential equations and solve such linear ordinary differential equations.
2. Describe the basics of vector spaces and linear transformations.
3. Apply Laplace transforms to find the solution of initial value problems.
4. Demonstrate the concept of Analytic functions & its constructions.
5. Evaluate Complex Integration, Taylor's and Laurent's Expansion, Singularities and Residues.

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
UNIT-I	Linear differential equation with constant Coefficient, Complimentary Functions, Particular Integrals, Euler – Cauchy differential equations, Second order linear differential equations – Variation of Parameters & Method of undetermined coefficient. Application domain problems: Electric field, rate of growth and decay of population dynamic, Antenna Design	12

UNIT-II	Binary composition, internal and external composition, Vector Spaces- Definition and Examples, Vector subspaces, Linear combination of Vectors, Basis and Dimension of Vector Spaces. Linear transformations, Properties of Linear Transformation, Null space and range of linear Transformation, Matrix representation of linear transformation. Application domain problems: Image processing, Creating and manipulating 3D models	12
UNIT-III	Laplace Transforms, Existence theorem, Standard Properties, Laplace transforms of Derivatives and Integrals, Unit Step Function, Laplace Transform of Periodic functions, Inverse Laplace Transforms, Convolution theorem, Applications of Laplace transforms for solving IVP. Application domain problems: Signal transformation and control systems	12
UNIT-IV	Function of complex variables: Limit, continuity, Differentiability and Analyticity of functions, Cauchy-Riemann Equations (Cartesian and polar forms), Harmonic functions, Construction of Analytic Function, Determination of Harmonic conjugate, Milne-Thomson's method. Application domain problems: Special functions and error functions, Computer graphics for rendering images, modeling surfaces, and creating visual effects.	12
UNIT-V	Line integral, Cauchy's Integral Theorem, Cauchy's Integral Formula, Cauchy's Integral Formula for Derivatives, Cauchy's Inequality, Taylor's, and Laurent's Expansions (statements only), Singularities, Poles and Residues, Cauchy's residue Theorem, Applications - Evaluation of real integrals $\int_0^{2\pi} f(\sin \theta, \cos \theta) d\theta$ over $(0, 2\pi)$ . Application domain problems: Electrical circuits, Image processing and communication system, Diffraction on a flat screen.	12

### TEXT BOOKS/REFERENCE BOOKS

1. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford first edition, 2015.
2. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017
3. S. H. Friedberg, Arnold J. Insel, E. S. Lawrence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
4. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017
5. Kandasamy P et al. Engineering Mathematics, S. Chand & Co., New Delhi, revised edition.
6. Dass H. K., Advanced engineering Mathematics, Sultan Chand Publication, Delhi, 2013.

Mathematics-II (For BME only)	
Course Code: 25AS204	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60Marks
L T P : 3 1 0	
Prerequisite: Mathematics-I	

### COURSE OBJECTIVES (COs):

1. To familiarize with the concept of complex variables.
2. To introduce the concept of successive differentiation and nth derivatives.
3. To introduce the concept of Differentiation of several variables.
4. To familiarize with concepts of vector and vector differentiation.
5. To introduce the concept of differential equations and their applications

### COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Apply the knowledge to construct analytic functions.
2. Execute the higher order differentiation.
3. Develop the essential tool of differentiation of several variables.
4. Illustrate the concept of vector differentiation.
5. Apply the knowledge of differential equations in solving problems

### MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

COs/CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

### COURSE CONTENTS

UNIT	COURSE CONTENTS	HOURS
UNIT-I	Complex numbers and their properties, Complex plane, Polar form of complex numbers, Powers and Roots, Sets of Points in the Complex plane, De-Moivre's theorem and its simple applications. <b>Application domain problems:</b> Signal processing of bio-signals	12
UNIT-II	Successive differentiation, nth order derivatives of standard functions, Leibnitz theorem (without proof) <b>Application domain problems:</b> Population dynamics	12
UNIT-III	Introduction, Limit & Continuity, Partial derivatives, Homogeneous functions and Euler's theorem, Total derivatives, Jacobians, Properties of Jacobians. <b>Application domain problems:</b> Analysis of blood flow, stability	12

	analysis	
<b>UNIT-IV</b>	Introduction, Scalar and vector point functions, differentiation formulae, Level surface, Gradient, Divergence, Curl, Directional derivatives, Simple Applications. <b>Application domain problems:</b> Analysis of bio fluids in biomechanics	12
<b>UNIT-V</b>	Linear differential equation with constant Coefficient, Complimentary Functions, Particular Integrals, Euler – Cauchy differential equations, Second order linear differential equations – Variation of Parameters & Method of undetermined coefficient. <b>Application domain problems:</b> Mathematical modelling in biology	12

### TEXTBOOKS/REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2020.
2. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 7<sup>th</sup> Edition, Narosa Publishing House, 2021.
3. Bali N.P., Goyal M., Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
4. Dass H.K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

<b>HINDI -II</b>	
<b>Course Code: 25HIN202</b>	<b>Continuous Evaluation: 40 Marks</b>
<b>Credits: 2</b>	<b>End Semester Examination:60 Marks</b>
<b>L T P : 2 0 0</b>	
<b>Prerequisite: Nil</b>	

### **COURSE OBJECTIVES (COs)**

हिंदी विषय के प्रश्नपत्र की सामग्री निर्धारण में ज्ञान तथा शिक्षा के बदलते परिप्रेक्ष्य को ध्यान में रखा गया है। इस सत्र में हिंदी लघु कथाओं को सम्मिलित किया गया है। छात्रों की मौखिक अभिव्यक्ति की क्षमता का विकास करने में निहित मूल्यों का महत्वपूर्ण योगदान होता है, इससे विद्यार्थियों की कल्पनाशक्ति के विकास के साथ-साथ मनोरंजन भी होता है। संचार कौशल में मुहावरे, लोकोक्तियां, पत्रलेखन और अपठित गद्यांश की समझ के द्वारा हिंदी का प्रचार-प्रसार होगा। इस प्रकार साहित्य के ज्ञान की अभिवृद्धि वैश्वीकरण के संदर्भ में प्रासंगिकता और उपयोगिकता सिद्ध करती है।

### **COURSE LEARNING OUTCOMES (CLOs)**

पाठ्यक्रम परिणाम

#### **1. Knowledge Outcome**

ज्ञान का परिणाम

**At the end of the course, the student should be able to**

1. पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए
2. हिंदी लघुकथाओं के मूल उद्देश्य को समझने में विद्यार्थी निपुण हो जाएंगे। लघुकथाओं से क्या शिक्षा मिलती है? इसका ज्ञान छात्रों को होगा। व्याकरण के अध्ययन से विद्यार्थियों को भाषा बोलने, लिखने और पढ़ने में सहायता प्राप्त होगी

#### **2. Skill Outcome**

कौशल का परिणाम

**At the end of the course, the student should be able to**

(At the end of the course, the student should be able to)

1. -पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए
2. -हिंदी लघुकथाओं से मनोरंजन भी होगा |
3. -विद्यार्थी लघुकथाओं के मूलकथ्य को समझेंगे।
4. -विचार तत्व के बोध से अवगत होंगे।
5. -हिंदी में पत्र लेखन और अपठित गद्यांश को समझने में सक्षम होंगे |

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	इस इकाई में हिंदी लघुकथाओं का संक्षिप्त परिचय दिया गया है – 1. हिंदी लघुकथा का सामान्य परिचय   2. हिंदी लघुकथा के प्रमुख प्रकार	8
<b>UNIT-II</b>	इस इकाई में हिंदी की दो लघुकथाएं सम्मिलित की गई हैं- 1. अंगूर की बेल 2. किसान और ठग	8
<b>UNIT-III</b>	इस इकाई में हिंदी की दो लघुकथाएं सम्मिलित की गई हैं- 1. बुराई का फल 2. चार विद्वान ब्राह्मण	7
<b>UNIT-IV</b>	यह इकाई संचार कौशल से सम्बंधित है, इसमें	7

	(i) प्रेसरिपोर्ट, विज्ञापन, अनुवाद (ii) हिंदी पत्र लेखन और अपठित गद्यांश को समझना व तर्क संगत उत्तर देना अपेक्षित है।	
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### **METHODOLOG पद्धति**

- कक्षाव्याख्यान
- व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा।
- समय-समय पर छात्रों को प्रदत्त कार्य दिया जाएगा।
- साप्ताहिक प्रश्नावली।
- दैनिक प्रश्नावली

### **REFERENCE BOOKS/ TEXT BOOKS**

आवश्यक पुस्तकें और सामग्री

1. पाठ्यक्रम में निर्धारित लघुकथाओं का संकलन।
2. -भाषा विज्ञान, डॉ. भोलानाथ तिवारी, किताब महल इलाहाबाद।
3. -हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन

<b>GERMAN-II</b>	
<b>Course Code:</b> 25FLGR202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> GERMAN-I	

### **COURSE OBJECTIVES (COs)**

The objective of this course is to impart basic knowledge of German language to the students. The course intends to grow the ability of verbal and written communication. Overall, the objective is to facilitate comprehension of daily life contexts in German, both oral as well as written.

1. To develop oral and written skills of understanding, expressing and exchanging information in German language.
2. To develop awareness of the nature of language and language learning.
3. To develop the ability to construct sentences and frame questions.
4. To provide German language as a competitive edge in career choices.
5. To know some of the aspects of the culture of the countries where German language is spoken.

### **COURSE LEARNING OUTCOMES (CLOs)**

After completion of the course the students will have the ability to:

1. Read and write short, simple texts.
2. Understand and take part in short, simple conversations using the skills acquired.
3. Know some aspects of the culture of the countries where the German language is spoken.
4. Read a text and/or e-mail during any employment.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>COs/CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
CO1	√	√		
CO2	√			
CO3		√		
CO4				√
CO5			√	

### **COURSE CONTENTS**

<b>UNIT</b>	<b>COURSE CONTENTS</b>	<b>HOURS</b>
<b>UNIT-I</b>	<ul style="list-style-type: none"> <li>- Zeitangabe, Tageszeit, Uhrzeit, der Tagesablauf</li> <li>- Präpositionen mit Akkusativ, Ordinalzahlen</li> <li>- Wegbeschreibung, die Himmelsrichtungen</li> <li>- Die Gebäude, Verkehrsmittel</li> </ul>	8
<b>UNIT-II</b>	<ul style="list-style-type: none"> <li>- Das Haus</li> <li>- Modalverben</li> <li>- Essen und Trinken, Messeinheiten, Einkaufen</li> <li>- Körperteile und Krankheiten</li> <li>- Futur</li> </ul>	8
<b>UNIT-III</b>	<ul style="list-style-type: none"> <li>- Dativ, Artikel und Personalpronomen im Dativ</li> <li>- Präpositionen mit Dativ, die Wechselprepositionen</li> <li>- Possessiv-Artikel, die Konnektoren</li> </ul>	7

	<ul style="list-style-type: none"> <li>- Schreiben Teil 1</li> <li>- Trennbare Verben</li> </ul>	
<b>UNIT-IV</b>	<ul style="list-style-type: none"> <li>- Schreiben Teil 2 (E- Mail Schreiben)</li> <li>- Perfekt</li> <li>- Vergangenheit erzählen, Das Wochenende, Lebenslauf</li> </ul>	7

### **TEXT BOOKS**

1. Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)by StefanieDengler, et al.Ernst Klett Sprachen., 2019.

### **OPEN EDUCATIONAL RESOURCES**

1. Website for additional materials: <https://www.nthuleen.com/teach.html>

### **REFERENCE BOOKS**

1. Studio D A1, Hermann Funk, Christina Kuhn, Silke Demme, 2010, Cornlesen.
2. Einfach Grammatik: Übungsgrammatik Deutsch A1 bis B1, Paul Rusch, Helen Schmitz, 2012, Langenscheidt.
3. Berliner Platz - neu: Lehr- und Arbeitsbuch, Christiane Lemcke, Lutz Rohrmann, Theo Scherling, 2009, Klett Sprachen.
4. Tangram aktuell 1: A1, Rosa-MariaDallapiaza, Eduard von Jan, Sabine Dinsel, 1998, Hueber Verlag.
5. Lernziel Deutsch: Deutsch als Fremdsprache, Teil 1, Wolfgang Hieber, 1984, Max Hueber Verlag.

<b>FRENCH-II</b>	
<b>Course Code:</b> 25FLFR202	<b>Continuous Evaluation:</b> 40 Marks
<b>Credits:</b> 2	<b>End Semester Examination:</b> 60 Marks
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> French-I	

### **COURSE OBJECTIVES (COs)**

1. To develop the skills to construct short and simple sentences.
2. To prepare the students to identify themselves with the culture of the Francophone world.
3. To develop in students a good degree of understanding of syntactic, lexical, grammatical and stylistic features of the French language.
4. To demonstrate differences and diversity of the French speaking world with their own

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of the course, students would be able to:

1. Express themselves in French used in daily conversations.
2. Recognise and explain cultural artefacts, practices and perspectives of the French speaking world.
3. Apply linguistic knowledge to analyse a simple text, identifying its salient features, and thus express themselves effectively in French.
4. Contrast culture of the French speaking world with their own, and hence demonstrate an increased awareness towards its key practices and perspectives.

### **MAPPING MATRIX OF COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

COs/CLOs	CLO1	CLO2	CLO3	CLO4
CO1	√		√	
CO2		√		√
CO3			√	
CO4				√

### **COURSE CONTENTS**

UNIT	Unités	Objectifs de Communication	Grammaire	Lexique	Heures
<b>UNIT-I</b>	<b>Journée Typique</b>	Parler d'habitudes, Exprimer l'Heure, S'Informer sur l'Heure, Moment et Fréquence.	Verbes Pronominaux au Présent. Verbes Aller et Sortir	Heure, Moments de la Journée. Activités Quotidiennes. Adverb. Météo.	8
<b>UNIT-II</b>	<b>Achats</b>	S'informer sur un Produit. Acheter et Vendre un Produit. Donner Son Avis. Parler du temps.	Adjectifs Interrogatifs. Adjectifs Démonstratifs(Ce, cette, ces). Genre et	Vêtements. Couleurs. Fruits et Légumes.	8

			Nombre. Verbe Prendre.		
<b>UNIT-II I</b>	<b>Alimentation</b>	Parler des Plats et des Aliments. Commander un Menu dans un Restaurant. Situer une Action dans le Futur	Future Proche: Aller +Infinitif. Articles Partitifs(du/de la/des/d'). Pronoms COD. Future.	Aliments. Vocabulaire des Quantités.	7
<b>UNIT-I V</b>	<b>expérience vécue</b>	Parler du passé. Parler d'expériences. Parler de ce que nous savons faire.	Passé Composé. Imparfait	Verbes Savoir, Pouvoir et Connaître. Adjectifs Qualificatifs. Vocabulaire des Savoirs et Compétences. Récit de Vie.	7

### TEXT BOOKS

1. Version Originale 1, Livre de l'élève: Denyer M. & Agustin Garmendia A. & Olivieri M L L., éd. Maisons des Langues, Paris. 2013.

### REFERENCE BOOKS

1. Alter Ego 1, Livre d'élève, Berthet A. & Hugo C. & Kizirian M. V. & Sampsonis B. & Waendendries M., éd Hachette, Paris, 2006.
2. Connexions 1, Loiseau Y. & Mérieux R., éd. Didier, Paris, 2004.
3. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, CLE International, Paris, 2013.
4. Le Robert & Nathan Conjugation, Paperback, Le Robert Nathan.

## SEMESTER – III

ENGINEERING MATHEMATICS – III (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24AS301	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

### COURSE EDUCATIONAL OBJECTIVES (CEO)

1. To familiarize the students with concepts of Fourier series.
2. To familiarize the students with partial differential equations and their solution.
3. To solve boundary value problems, Heat and Wave equations.
4. To gain good knowledge in the application of Fourier transform.
5. To demonstrate understanding of the Z-transform.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate Fourier series in engineering applications.
2. Elaborate different types of partial differential equations.
3. Find solutions of boundary value problems including heat and wave equations.
4. Apply and analyze Fourier transforms with different applications.
5. Evaluate the problems using Z-transforms.

### MAPPING COURSE EDUCATIONAL OBJECTIVES & COURSE LEARNING OUTCOMES

CEO	CLO	CLO1	CLO2	CLO3	CLO4	CLO5
CEO1		✓				
CEO2			✓			
CEO3				✓		
CEO4					✓	
CEO5						✓

### COURSE CONTENTS

<b>UNIT-I</b>	Periodic functions, Fourier Series, Dirichlet's Conditions for a Fourier Series, Fourier Series of discontinuous functions, Even and Odd functions, Half-range series (Period 0 to $\pi$ ), Change of Interval and Functions having arbitrary Period, Half-period Series, Parseval's Formula, Practical Harmonic Analysis. <b>Application domain problems:</b> Signal and vibration analysis
<b>UNIT-II</b>	Introduction, Partial Differential Equations, Order, Method of Formation of Partial Differential Equations, Solution of Equation by Direct Integration, Lagrange's Linear Equation of first order. Solution of Linear Partial Differential Equations with Constant Coefficients. <b>Application domain problems:</b> Scientific computing of modelling problem in real world scenario

<b>UNIT-III</b>	Classification of Partial Differential Equations, Method of Separation of Variables, Solution of One -Dimensional Wave Equation, Solution of One- Dimensional Heat Equation. <b>Application domain problems:</b> Modelling problem of mechanics
<b>UNIT-IV</b>	Introduction, Linear Property, Shifting Property, Change of Scale Property, Modulation Theorem, Fourier Transform of Derivatives, Fourier transform of Integrals, Fourier Transform of Dirac-Delta Function, Fourier Cosine Transform, Fourier Sine Transform, Fourier Sine and Cosine Transforms of Derivatives, Finite Fourier cosine Transform, Finite Fourier sine Transform, Convolution Theorem , Parseval's Identity (without proof)- applications. <b>Application domain problems:</b> Analyzing and processing signals in the time and frequency domains.
<b>UNIT-V</b>	Introduction, Definition of Z- transform, Linear property , Frequency Shifting , First Shifting, Second Shifting, Differentiation in z-domain, Initial and Final value theorems, Convolution theorem, Z-transforms of basic functions, Inverse Z – transform using partial fraction and long division methods. Simple applications of Z – transform to different equations. <b>Application domain problems:</b> Analyzing frequency responses of discrete system

#### **TEXT BOOKS/REFERENCE BOOKS**

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2020.
2. Raisinghania M.D., Advanced Differential Equations, S. Chand Publishing, 2018.
3. Ramana B.V., Higher Engineering Mathematics, McGraw Hill Education, 2017.
4. Churchill R.V. and Brown J., Fourier series and Boundary Value Problems, McGraw-Hill Book Education, 8th Edition, 2017.
5. Kreyszig, E., Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017.

## DATA STRUCTURE

Course Code: 25CS2001	<b>Continuous Evaluation:</b> 40 Marks
Pre-Requisite: NIL	<b>End Semester Examination:</b> 60 Marks
L T P: 3 0 0	
Credits: 3	

### COURSE OBJECTIVES

1. To understand the concepts of ADTs.
2. To understand sorting, searching and hashing algorithms.
3. To Learn linear data structures – stacks, and queues.
4. To understand non-linear data structures – trees.
5. To understand non-linear data structures – graphs.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Define linear and non-linear data structures.
2. Analyze the various searching and sorting algorithms.
3. Implement linear data structure operations.
4. Use appropriate non-linear data structure operations for solving a given problem of trees.
5. Apply appropriate graph algorithms for graph applications.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs:** SDG-4,SDG-8,SDG-9,SDG-12

## **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENT</b>
<b>UNIT-I</b>	<b>Linear Data Structures &amp; ADTs</b> Introduction to Data Structures: Abstract Data Types (ADTs): Array-based and Linked List Implementations-Singly, Doubly, and Circular Linked Lists; Applications – Polynomial operations;Dynamic arrays; Multilists;Representation and real-world application in sparse data processing (e.g., Big Data pipelines)
<b>UNIT-II</b>	<b>Searching, Sorting &amp; Hashing</b> Searching – Linear and Binary Search; Sorting – Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort;Heap Sort;Radix Sort, Shell Sort; Hashing – Hash Functions, Collision Resolution (Chaining, Open Addressing); Bloom Filters; Applications in Symbol Tables & Indexing
<b>UNIT-III</b>	<b>Stacks, Queues &amp; Recursion</b> Stack ADT – Operations and Applications; Expression Evaluation – Infix to Postfix, Prefix; Function Call Stack; Recursion fundamentals – Stack frames, Backtracking, Tail recursion; Queue ADT – Linear Queue, Circular Queue, Double-Ended Queue; Applications of Queues
<b>UNIT-IV</b>	<b>Tree and its Applications</b> Tree ADT; Binary Tree – Traversals (Preorder, Inorder, Postorder, Level-order); Binary Search Tree (BST); AVL Trees; Heaps and Priority Queues; Segment Trees and Applications;Expression Trees;Red-Black Tree;Minimum Spanning Tree – Prim’s Algorithm, Kruskal’s Algorithm;Union-Find / Disjoint Set Union (DSU);B-Trees, B+ Trees; M-Way Search Tree;Red Black trees
<b>UNIT-V</b>	<b>Graphs</b> Graph Representation – Adjacency Matrix, Adjacency List; Graph Traversals – BFS, DFS; Topological Sort;Connected Components, Bi-connectivity.

## **TEXT BOOKS**

1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" 6th Edition (2023) Publisher: CareerMonk Publications ISBN: 978-8193245279
2. Seymour Lipschutz – Data Structures with C "Data Structures with C" Publisher: McGraw Hill Education
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
4. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007.

## **REFERENCE BOOKS**

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser "Data Structures and Algorithms in Python" 2nd Edition (2024) Publisher: Wiley ISBN: 978-1119860917
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein "Introduction to Algorithms" Edition: 4th Edition (2022) Publisher: The MIT Press ISBN: 978-0262046305
3. Mark Allen Weiss "Data Structures and Algorithm Analysis in C++" 4th Edition (2023) Publisher: Pearson ISBN: 978-0132847377
4. Bradley N. Miller, David L. Ranum "Problem Solving with Algorithms and Data Structures Using Python" 3rd Edition (2023) Publisher: Franklin, Beedle & Associates ISBN: 978-1590284079
5. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.

## Open Sources for Learning

- <https://www.youtube.com/c/takeUforward>
- <https://www.youtube.com/c/CodeWithHarry>
- <https://www.youtube.com/c/GeeksforGeeksVideos>
- <https://www.youtube.com/c/ApnaCollegeOfficial>

## Other Sources

- <https://dl.acm.org/journal/talg>
- <https://link.springer.com/journal/453>
- <https://www.journals.elsevier.com/theoretical-computer-science>
- <https://dl.acm.org/journal/csur>
- <https://dl.acm.org/journal/jacm>
- <https://www.journals.elsevier.com/information-processing-letters>

## DATABASE MANAGEMENT SYSTEMS

Course Code: 25CS2005	<b>Continuous Evaluation:</b> 40 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 60 Marks
LT P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVES

1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. To understand the relational database design principles.
4. To familiarize with the basic issues of transaction processing and concurrency control.
5. To understand several database concepts like Object Database, Distributed Database, Mobile Database, Temporal Database.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
2. Design the database schema with the use of appropriate data types for storage of data in database
3. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.
4. Apply and create a Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respective data into RDBMS and on the data.
5. Understand and apply the concept of transaction, concurrency control and recovery in database.
6. Understand some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

### COURSE LEARNING OUTCOME (CLO) - COURSE OBJECTIVE (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
C01	✓	✓				
C02			✓			
C03				✓		
C04					✓	
C05						✓

**Mapped SDGs:** SDG-4,SDG-8,SDG-9,SDG-17

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	<b>Introduction</b> Database System and its Applications, Purpose of Database Systems, Abstraction, Instances and Schemas, Data Models, Database Languages - DDL, DML, Database Architecture, Types of Database Users, Database design, ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Degree of Relationship, Conceptual Design with the ER Model, Relational Model: Integrity Constraints over Relations, Querying relational data, Logical database Design, Introduction to Views: Altering Tables and Views.
UNIT-II	<b>RELATIONAL ALGEBRA AND CALCULUS</b> Relational Algebra - Selection and Projection, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus: Tuple and Domain relational calculus. Basic SQL Queries, Nested Queries, Correlated Nested Queries. Set operations Comparison Operators, Aggregate Operators, NULL values, Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Complex Integrity Constraints in SQL, Triggers and Active Databases.
UNIT-III	<b>UNIT - III NORMALIZATION:</b> Introduction to Normalization and Schema, Types of Keys, Concept of Redundancy, Decompositions - Problem related to decomposition, Functional Dependencies, Normal Forms and Dependencies- FIRST, SECOND, THIRD, BCNF and FOURTH, FIFTH NF. Types of Decomposition- Lossless and Lossy Join Decomposition, Functional Dependency Preservation, Irreducible Set of Functional Dependencies, Schema Refinement in Database Design - Multi valued Dependencies.
UNIT-IV	<b>TRANSACTIONS &amp; RECOVERY:</b> Transaction management: ACID Properties, Transaction states, Concurrency control: Concurrency Control - Overview, Concurrency control problems, Locks, Locking Protocols, Deadlocks, Serializability, Recovery System: Types of Failures, Recovery Techniques.
UNIT-V	<b>Unit - V CURRENT TRENDS:</b> Types of Databases: Object Oriented DBMS, Distributed Database, Parallel Database, Mobile database, Geographic Information System-Multimedia Database, Temporal Database, Data Warehousing and Data Mining.

## TEXT BOOKS

1. S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
2. Greg Turnquist Fundamentals of a Relational Database — 2024.
3. Elvis C. Foster & Shripad V. Godbole, Database Systems: A Pragmatic Approach –3rd Edition, CRC Press / Taylor & Francis, 2022.
4. Thomas Connolly, Carolyn Begg. Database Systems, 3<sup>rd</sup> Edition – Pearson Education.

5. Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
6. Date C. J., An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

#### **REFERENCE BOOKS**

1. Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
2. Distributed Database Systems by Chhanda Ray — 1st Edition (May 2024).
3. M.Tamer Ozsu , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.
4. Vipin.C.Desai , An introduction to Database System , West Pub. Co

#### **OPEN EDUCATIONAL RESOURCES (OER)**

1. NPTEL: NPTEL DBMS Course (Prof. P. Dasgupta, IIT KGP).  
Link: <https://nptel.ac.in/courses/106105175>.
2. MIT OpenCourseWare – Database Systems (6.830)  
Link: <https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/>
3. Introduction to Database Systems – IIT Madras (NPTEL, 2025),  
Link: [https://onlinecourses.nptel.ac.in/noc25\\_cs40/preview?utm\\_source=chatgpt.com](https://onlinecourses.nptel.ac.in/noc25_cs40/preview?utm_source=chatgpt.com)

## PROGRAMMING IN PYTHON

Course Code: 25CS2007	<b>Continuous Evaluation:</b> 40 Marks
Pre-Requisite : Basic Programming Fundamentals	<b>End Semester Examination:</b> 60 Marks
L T P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVE

1. Understand the fundamental concepts of Python programming including data types, control structures, and structured data types.
2. Apply functional programming constructs, input/output operations, and various Python operators to solve computational problems.
3. Develop object-oriented Python programs using modules, classes, inheritance, and exception handling for modular and robust design.
4. Utilize file handling techniques, regular expressions, and package management for effective data storage and processing.
5. Perform data analysis and visualization using Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn to solve real-world data science problems.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Demonstrate understanding of Python syntax, data types, structured data types, and control structures to write basic programs.
2. Implement functional programming paradigms using user-defined and anonymous functions, recursion, generators, and decorators.
3. Develop and apply object-oriented programming principles including class creation, inheritance, and error handling in Python.
4. Construct file I/O operations and apply regular expressions and standard libraries to manipulate and process various file formats.
5. Analyze, manipulate, and visualize datasets using popular Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs:** SDG-4, SDG-8, & SDG-9

## **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>CONTENTS</b>
<b>UNIT-I</b>	<p><b>Fundamentals of Python Programming</b> <b>Introduction of Python:</b> History and Need for Python, Python Installation and IDLE, Python Syntax, Identifiers, and Keywords.</p> <p><b>Data Types and Objects:</b> Basic Data Types: Integral and Floating Point, Numerical Types and Expressions, Variables and Constants, Comments and Documentation Strings, Type Conversion.</p> <p><b>Branching and Iteration:</b> Conditional Statements (if, elif, else), Looping Constructs (for, while), Control Flow Statements (break, continue, pass), Iteration Techniques.</p> <p><b>Structured Data Types:</b> List, Working with Lists, Tuples and Tuple Methods, Unpacking sequences, Ranges, Mutable Sequences, List Comprehensions, Sets, Set Methods, Frozen sets, Dictionaries, Dictionary Methods, Default Dictionaries, Ordered Dictionaries, and Traversal.</p>
<b>UNIT-II</b>	<p><b>Functions, Input/Output, and Operators</b> <b>Basic Input/Output:</b> Reading from and Writing to the Console, Working with Strings and String Methods, String Slicing.</p> <p><b>Functions:</b> Built-in and User-Defined Functions, Function Arguments: Positional, Keyword, Default, Variable Length, Returning Values from Functions, Scope of Variables: Local and Global, The Global Keyword and Passing Groups of Elements, Recursive Functions, Anonymous Functions(Lambda) with 'filter()', 'map()', 'reduce ()'.</p> <p><b>Operators and Expressions:</b> Expressions, Assignment, Arithmetic, Comparison, Logical, Bitwise Operators, Membership and Identity Operators, Complex Expressions and Precedence Rules, Boolean Expression.</p>
<b>UNIT-III</b>	<p><b>Object-Oriented Programming and Exception Handling</b> <b>Modules:</b> Creating and Using Modules, The Special Variable '__name__', Structured Programming Principles.</p> <p><b>Classes in Python:</b> New Style Classes, Creating Classes, Instance Methods, Inheritance, Polymorphism, Method overriding.</p> <p><b>Exception Handling:</b> Types of Errors (Compile- Time, Runtime, Logical), Exception Handling Using try-except Blocks, The assert Statement, User-Defined Exceptions, Exception Classes &amp; Custom Exceptions.</p>
<b>UNIT-IV</b>	<p><b>File Handling, Regular Expressions, and Iterators</b> <b>File Handling:</b> Files – Types of Files, Creating and Reading Text Data, File Write Data, Reading and Writing Files (Binary,Text), The Pickle Module, Working with CSV and JSON files, File and Directory Management.</p> <p><b>Regular Expressions:</b> RE Operations, Using Special Characters, RE Methods, Named Groups.</p> <p><b>Iterators and Generators:</b> Iterator Protocol, Generators and Yield Statement.</p> <p><b>Packages:</b> Importing Modules, Creating and Using Packages.</p>

<b>UNIT-V</b>	<p><b>Data Analysis and Visualization with Python</b></p> <p><b>Introduction to Data Science:</b> Overview of Data Science Workflow, Python Libraries for Data Science (NumPy, Pandas, SyS, SciPy, Scikit-learn), Working with Arrays Using Libraries like NumPy.</p> <p><b>Data Analysis and Visualization:</b> Analyzing Numerical Data with NumPy, Data Manipulation with Pandas, Data Visualization Techniques, Plotting with Matplotlib and Seaborn.</p>
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#### **TEXT/REFERENCE BOOKS**

1. Boschetti, A., & Massaron, L. (2018). *Python Data Science Essentials: A Practitioner's Guide Covering Essential Data Science Principles, Tools, and Techniques* (3rd ed.). Packt Publishing
- Gowrishankar S., & Veena A. (2018).
2. *Introduction to Python Programming* (1st ed.). Chapman and Hall/CRC.

#### **REFERENCE BOOKS**

1. Downey, A. B. *Think Python: How to Think Like a Computer Scientist*, 2nd Edition (Green Tea Press/O'Reilly, 2015). Free eBook under CC BY-NC 3.0.
2. Lutz, M. (2025). *Learning Python: Powerful object-oriented programming* (6th ed.). O'Reilly Media. ISBN 978-1-09817-1308.

#### **OPEN EDUCATIONAL RESOURCES**

1. Runestone Interactive Python Books by Runestone Academy. <https://runestone.academy/>
2. The Joy of Computing Using Python by Prof. Sudarshan Iyengar, NPTEL, IIT Ropar. <https://nptel.ac.in/courses/106106182>

**DATABASE MANAGEMENT SYSTEMS LAB**

Course Code: 25CS2111	<b>Continuous Evaluation:</b> 60 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 40 Marks
L T P : 0 0 2	
Credits: 1	

**COURSE OBJECTIVES**

1. To explain the basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations. And describe the basics of SQL and construct queries using SQL.
3. To emphasize the importance of normalization in databases.
4. To facilitate students in Database design.
5. To familiarize issues of concurrency control and transaction management.

**COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
2. Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
3. Formulate query, using SQL, solutions to a broad range of query and data update problems.
4. Design and implement database applications on their own.
5. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.
6. Analyze and Select storage and recovery techniques of database systems.

**COURSE LEARNING OUTCOME (CLO) - COURSE OBJECTIVE (CO) MAPPING**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>
<b>CO1</b>	√					
<b>CO2</b>		√	√			
<b>CO3</b>			√			
<b>CO4</b>				√		
<b>CO5</b>					√	√

**Mapped SDGs:** SDG-4,SDG-8,SDG-9,DSG-17

**LIST OF EXPERIMENTS**

1. To study SQL and implement Basic SQL commands (create database, create table, use , drop, insert) and execute the queries using these commands.
2. To Implement the viewing commands (select , update) and execute the queries using these commands.
3. To implement the commands to modify the structure of the table (alter, delete, drop, add, modify ) and execute the queries using these commands.
4. Write a program which involves compound conditions (and, or, in , not in, between ,not between , like , not like) and execute the queries using these commands.

5. To Implement the aggregate functions (sum, count, max, min, average) and execute the queries using these commands.
6. To Implement the grouping commands (group by, order by)
7. To Implement the commands involving data constraints.
8. To Implement the commands for aliasing and renaming and execute the queries using these Commands.
9. Write a program to execute the queries for joins ( cross join, inner join, outer join)
10. To Implement Integrity Constraints in SQL.
11. Write a program to implement the Use of Group By and Having Clause.
12. Write a program to perform the queries for triggers (Creation of insert trigger, delete trigger, update trigger).

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

#### **TEXT BOOKS**

1. Cathy Tanimura , SQL for Data Analysis: Advanced Techniques for Transforming Raw Data into Insights , 2025.
2. Anthony Molinaro, SQL Cookbook: Query Solutions and Techniques,2020
3. S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
4. Thomas Connolly, Carolyn Begg. Database Systems, 3<sup>rd</sup> Edition – Pearson Education.
5. Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
6. Date C. J.An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

#### **REFERENCE BOOKS**

1. Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
2. Alan Beaulieu, Learning SQL, 3rd Edition (2020)
3. Vipin.C.Desai , An introduction to Database System , West Pub. Co

#### **OPEN EDUCATIONAL RESOURCES (OER):**

1. MIT OpenCourseWare – Database Systems (6.830)  
Link: <https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/>
2. Introduction to Database Systems – IIT Madras (NPTEL, 2025),  
[https://onlinecourses.nptel.ac.in/noc25\\_cs40/preview?utm\\_source=chatgpt.com](https://onlinecourses.nptel.ac.in/noc25_cs40/preview?utm_source=chatgpt.com)
3. NPTEL: **Database Management System** – IIT Kharagpur  
Link: [https://onlinecourses.nptel.ac.in/noc22\\_cs91/preview?utm\\_source=chatgpt.com](https://onlinecourses.nptel.ac.in/noc22_cs91/preview?utm_source=chatgpt.com)

## PYTHON PROGRAMMING LAB

Course Code: 25CS2015	<b>Continuous Evaluation:</b> 60 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 40 Marks
L T P : 0 0 2	
Credits: 1	

### COURSE OBJECTIVE

1. To provide hands-on practice in Python basics including data types, control structures, and I/O operations.
2. To develop skills in implementing functions, recursion, and object-oriented programming using Python.
3. To train students in advanced features such as file handling, exception handling, and use of modules and packages.
4. To enable students to manipulate and analyze data using libraries such as NumPy and Pandas.
5. To build the ability to visualize, interpret, and present data insights using Python-based visualization tools.

### COURSE LEARNING OUTCOMES (CLO's)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of the course, the students will be able to:

1. Implement Python programs using basic syntax, data types, control statements, and built-in data structures.
2. Apply modular and object-oriented programming concepts to solve real-world problems in Python.
3. Perform robust data input/output operations, exception handling, and file manipulations.
4. Analyze and transform structured and unstructured data using NumPy and Pandas.
5. Create visualizations using Matplotlib and Seaborn to support data-driven decision-making.

### MAPPING COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO)

CLO CO	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

## LIST OF PROGRAMS

### 1. List, Dictionary, and Tuple Operations

#### Implement a program to:

- Perform basic operations on a list: insert(), remove(), append(), len(), pop(), clear()
- Work with a dictionary: create, access, update, delete, use get()
- Perform tuple operations: access, count, check for item, convert to list and modify

### 2. Conditional Statements and User Interaction

#### Implement a program to:

- Write a program to add two numbers
- Check if a number is positive, negative, or zero using if-else
- Find the largest among three numbers
- Display weekday name for a given number using if-elif-else

### 3. Looping Constructs

#### Implement a program to:

- Print multiplication table of a number
- Sum N natural numbers using while loop
- Check whether a number is prime using loop

### 4. Functions and Lambda Expressions

#### Implement a program to:

- Define a function to calculate factorial of a number
- Generate Fibonacci sequence using recursion
- Use lambda, map(), filter(), and reduce() on a list of integers utilize functions with different argument passing mechanisms

### 5. Object-Oriented Programming

#### Implement a program to:

- Create a Student class to accept and display student details
- Implement single and multilevel inheritance (e.g., Person → Student)
- Demonstrate polymorphism using method overriding

### 6. Exception Handling

#### Implement a program to:

- Write a calculator with try-except blocks to handle division by zero
- Raise a custom exception when a user enters invalid marks
- Use finally block to display a message or clean up

### 7. File Handling with Encryption

#### Implement a program to:

- Read and write a text file using with block
- Encrypt file content using a simple cipher and write to another file
- Decrypt the file and display original content

### 8. CSV and JSON File Processing

#### Implement a program to:

- Read and write structured student data using CSV
- Read and write expense data in JSON format
- Summarize CSV data (total students, average marks)

### 9. Regular Expressions in Practice

#### Implement a program to:

- Validate email, mobile number, and date format using regex
- Extract all email IDs from a text file

### 10. Modules, Packages, and Iterators

#### Implement a program to:

- Create a module with common functions and import it
- Build a package with submodules and use it

- Create an iterator and generator to produce even numbers

### 11. NumPy for Numerical Computing

#### Implement a program to:

- Create arrays and perform operations: add, subtract, reshape
- Perform matrix multiplication and slicing

### 12. Pandas for Data Analysis

#### Implement a program to:

- Create a DataFrame from a CSV and display first/last 5 rows
- Handle missing data and filter rows based on conditions

### 13. Data Visualization with Matplotlib and Seaborn

#### Implement a program to:

- Generate bar, line, and pie charts using Matplotlib
- Create heatmap and histogram using Seaborn

### 14. Exploratory Data Analysis (EDA)

#### Implement a program to:

- Analyze a dataset (e.g., student performance, COVID data) using Pandas
- Visualize distribution, relationships using Seaborn

### 15. Mini Project

- **Movie Ratings Analyzer:** Load IMDb/Netflix dataset, clean using Pandas, visualize top-rated movies by genre/year  
(*Personal Expense Tracker, Weather App, YouTube Downloader, etc.*)

## TEXT BOOKS

1. **"Head First Python: A Brain-Friendly Guide"**, Second Edition (Greyscale Indian Edition) by Paul Barry, O'Reilly / Shroff Publishers, December 2016
2. **"Automate the Boring Stuff with Python: Practical Programming for Total Beginners"** by Al Sweigart, 1st Edition, No Starch Press, May 1, 2015

## REFERENCE BOOKS

Shovic, J. C., & Simpson, A. (2019). Python All-In-One For Dummies (1st ed.). For Dummies.

1. **"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython"** by Wes McKinney, 3rd Edition, O'Reilly, 2022
2. **"Python All-in-One For Dummies"** by John C. Shovic and Alan Simpson, 1st Edition, For Dummies, 2019

## OPEN EDUCATIONAL RESOURCES

1. **"The Joy of Computing Using Python"** by Prof. Sudarshan Iyengar, NPTEL, IIT Ropar.  
<https://nptel.ac.in/courses/106106182>
2. **"Python for Everybody"** by Dr. Charles Severance, University of Michigan.  
<https://www.py4e.com/>

## DATA STRUCTURES LAB

Course Code: 25CS2113	<b>Continuous Evaluation:</b> 60 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 40 Marks
L T P : 0 0 2	
Credits: 1	

### COURSE OBJECTIVE

1. To demonstrate array implementation of linear data structure algorithms.
2. To implement the applications using Stack & Queue.
3. To implement Binary search tree and AVL tree algorithms.
4. To implement Prim's algorithm.
5. To implement Sorting, Searching and Hashing algorithms.

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Implement Linear data structure algorithms.
2. Implement applications using Stacks and Linked lists
3. Implement Binary Search tree and AVL tree operations.
4. Implement graph algorithms.
5. Analyze the various searching and sorting algorithms.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

CO	CLO	CLO1	CLO2	CLO3	CLO4	CLO5
C01		√				
C02			√			
C03				√		
C04					√	
C05						√

**Mapped SDGs: SDG-4,SDG-9,SDG-11**

## LIST OF PROGRAMS

1. Implement the basic operations (insertion, deletion, traversal, and search) on a singly linked list. Understand dynamic memory allocation and pointer manipulation.
2. Represent polynomials using linked lists. Perform polynomial addition and multiplication. Understand how linked structures enable dynamic term representation.
3. Develop linked list-based implementations for Stack and Linear Queue ADTs. Perform operations such as push, pop, enqueue, dequeue, and display.
4. Implement Stack, Linear Queue, and Circular Queue using arrays.
5. Implement a transformation of stack to queue (and vice versa) using arrays and linked lists to understand data structure interconversion logic.
6. Implement an algorithm to convert an infix expression to postfix and evaluate a postfix expression using stack data structures. Understand expression parsing and operator precedence.
7. Implement linear and binary search on both arrays and linked lists. Compare time complexity and discuss feasibility of binary search on linked structures.
8. Implement Insertion Sort and Selection Sort on arrays. Analyze their time complexity and behavior on partially sorted data.
9. Implement Merge Sort and Quick Sort for both arrays and linked lists. Understand divide-and-conquer strategies and compare performance in different cases.
10. Create a binary search tree and implement operations such as insertion, deletion, traversal (inorder, preorder, postorder), and search.
11. Extend the BST to support AVL Trees with self-balancing logic. Implement insertion and observe how balancing (rotations) maintains optimal tree height.
12. Implement a min-heap or max-heap to represent a priority queue. Perform insert, delete, and heapify operations to maintain heap properties.
13. Implement Dijkstra's algorithm for computing the shortest path from a source node to all other nodes in a weighted graph using an adjacency matrix or list.
14. Implement Prim's algorithm to generate a minimum spanning tree for a connected, weighted, undirected graph. Explore greedy strategies in graph processing.

### TEXT BOOK

1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" 6th Edition (2023) Publisher: CareerMonk Publications ISBN: 978-8193245279
2. Seymour Lipschutz - Data Structures with C "Data Structures with C" Publisher: McGraw Hill Education
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson, Education, 2005.
4. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

### REFERENCE BOOKS

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser "Data Structures and Algorithms in Python" 2nd Edition (2024) Publisher: Wiley ISBN: 978-1119860917
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein "Introduction to Algorithms" Edition: 4th Edition (2022) Publisher: The MIT Press ISBN: 978-0262046305
3. Mark Allen Weiss "Data Structures and Algorithm Analysis in C++" 4th Edition (2023) Publisher: Pearson ISBN: 978-0132847377
4. Bradley N. Miller, David L. Ranum "Problem Solving with Algorithms and Data Structures Using Python" 3rd Edition (2023) Publisher: Franklin, Beedle & Associates ISBN: 978-1590284079
5. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition,

Pearson Education, 2015.

6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Fourth Edition, McGraw Hill/ MIT Press, 2022.
7. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 1st edition, Pearson, 2002.
8. Kruse, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2006.

#### **Open Sources for Learning**

- <https://www.youtube.com/c/takeUforward>
- <https://www.youtube.com/c/CodeWithHarry>
- <https://www.youtube.com/c/GeeksforGeeksVideos>
- <https://www.youtube.com/c/ApnaCollegeOfficial>

#### **Others Resources**

- <https://dl.acm.org/journal/talg>
- <https://link.springer.com/journal/453>
- <https://www.journals.elsevier.com/theoretical-computer-science>
- <https://dl.acm.org/journal/csur>
- <https://dl.acm.org/journal/jacm>
- <https://www.journals.elsevier.com/information-processing-letters>

**Note:** Students may be asked to create a small project individually to show the application of data structures.

## SEMESTER – IV

### THEORY OF COMPUTATION

Course Code: 25CSPE2004	<b>Continuous Evaluation:</b> 40 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVES

1. Understand the foundations of formal languages and finite automata to model computational systems.
2. Develop the ability to construct and analyze regular expressions and grammars for language representation.
3. Gain proficiency in designing and simplifying context-free grammars, and identifying ambiguity.
4. Learn to model context-free languages using pushdown automata and simulate language recognition.
5. Explore Turing machines and foundational concepts of computability and undecidability in computation.

#### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Explain the foundational concepts of formal languages, grammars, and automata.
2. Design and analyze finite automata, regular expressions, and context-free grammars for language recognition.
3. Construct and simulate pushdown automata and Turing machines for appropriate language classes.
4. Apply theoretical tools like pumping lemmas and closure properties to classify languages.
5. Evaluate the power and limitations of computational models through concepts of decidability and undecidability.

#### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓	✓		✓	
C02		✓		✓	
C03	✓	✓		✓	
C04			✓		
C05			✓		✓

**Mapped SDGs: SDG-4, SDG-9, SDG-17**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Introduction to Formal Languages and Finite Automata</b> Concept of basic Machine, Properties and limitations of FSM, Moore and Mealy Machines, Equivalence of Moore and Mealy machines, pumping lemma, Alphabets, strings, languages, operations on languages, Finite Automata (DFA, NFA, $\epsilon$ -NFA), Conversion: $\epsilon$ -NFA $\rightarrow$ NFA $\rightarrow$ DFA, Equivalence of Finite Automata, Minimization of DFA
UNIT-II	<b>Regular Languages and Grammars</b> Regular expression conversion and vice versa. Conversion of NFA to DFA by Arden's Method, Regular Expressions and their equivalence with FA, Regular grammar (right-linear, left-linear), Closure properties of Regular Languages, Pumping Lemma for Regular Languages, Decision properties
UNIT-III	<b>Unit 3: Context-Free Grammars and Languages</b> CFG: Definition, Derivations, Parse Trees, Ambiguity in CFGs, Simplification: Removing null, unit, useless productions, Normal forms: CNF, GNF, Pumping Lemma for CFLs, Closure properties
UNIT-IV	<b>Unit 4: Pushdown Automata and CFLs</b> Pushdown Automata (PDA): Definition, transition diagrams, Acceptance by final state and empty stack, Design of PDA for CFGs, Deterministic v/s Non-deterministic PDA, Applications of PDA
UNIT-V	<b>Unit 5: Turing Machines and Undecidability</b> Turing Machine: Basic model, design of TM, Variants of TM: Multi-tape, non-deterministic, Recursive and Recursively Enumerable Languages, Church-Turing Thesis, Undecidability: Halting Problem, Post Correspondence Problem, Rice's Theorem, Closure properties of Turing machines.

## TEXT BOOKS

1. Peter Linz, *An Introduction to Formal Languages and Automata*, 6th Edition, Jones and Bartlett, 2016.
2. Dexter C. Kozen., *Automata and Computability*, 1st Edition, Ronald F. Clayton, Springer-Verlag New York Inc, 2016.
3. Anil Maheshwari and Michiel Smid., *Theory of Computation*, 1st Edition, Carleton University, 2016.
4. Vivek Kulkarni., *Theory of Computation*, 4th Edition, Oxford University Press, 2013.
5. Hopcroft J.E., Motwani R., Ullman J.D., *Introduction to Automata Theory, Languages and Computation*, 3rd Edition, Pearson Education, 2008.

## REFERENCE BOOKS

1. Martin J.C., *Introduction to Languages and the Theory of Computation*, 4th Edition, McGraw-Hill Education, 2010.
2. Lewis H.R. and Papadimitriou C.H., *Elements of the Theory of Computation*, 2nd Edition, Pearson Education, 2001.

## Open Sources for Learning

1. [Introduction to Theory of Computation - GeeksforGeeks](#)
2. [Theory of Computation \(TOC\) for GATE - GeeksforGeeks](#)
3. [Theory of Computation | Mathematics | MIT OpenCourseWare](#)

## Other Links

1. <https://www.journals.elsevier.com/theoretical-computer-science>.
2. <https://www.journals.elsevier.com/information-and-computation>.
3. <https://toct.acm.org/>.
4. <https://lmcs.episciences.org/>. <https://theoryofcomputing.org/>.

<b>OPERATING SYSTEMS</b>	
Course Code: 25CS2006	<b>Continuous Evaluation:</b> 40 Marks
Pre-Requisite : NIL	<b>End Semester Examination:</b> 60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To understand the main components of an OS &amp; their functions.</li> <li>2. To study process management and scheduling.</li> <li>3. To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.</li> <li>4. To understand the concepts and implement Memory management policies and virtual memory.</li> <li>5. To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.</li> <li>2. Understand the process management policies and scheduling of processes by CPU .</li> <li>3. Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.</li> <li>4. Describe and analyze the memory management and its allocation policies.</li> <li>5. Identify use and evaluate the storage management policies with respect to different storage management technologies.</li> </ol>

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>		√	√		
<b>CO3</b>		√	√		
<b>CO4</b>				√	√
<b>CO5</b>					√

**Mapped SDGs: SDG-4, SDG-9 & SDG-12**

### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>

<b>UNIT-I</b>	<p><b>INTRODUCTION</b>  <b>Operating System Overview</b>-Definition and functions, Types of Operating Systems, Various Operating system services.  <b>Operating System Structure</b>- Layered structure approach, kernel Approach and Virtual machine approach.</p>
<b>UNIT-II</b>	<p><b>PROCESSES &amp; SCHEDULING</b>  <b>Process concept</b>- Process State Diagram- PCB, Concept of Threading and Multithreading, Operation on processes, Scheduling criteria, CPU scheduling algorithms- FCFS, SJF, SRTF, RR, PRIORITY, HRRN.  <b>Deadlock</b>: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.</p>
<b>UNIT-III</b>	<p><b>CONCURRENCY</b>  Process Synchronization- Critical Section Problem, Classical Synchronization Problem. Principles of concurrency - mutual exclusion, semaphores, monitors, Readers/Writers problem, Producers/Consumers problem. Inter Process Communication models and Schemes, Process generation.</p>
<b>UNIT-IV</b>	<p><b>MEMORY MANAGEMENT STRATEGIES</b>  Address Binding, Logical-Physical Address Space, swapping, contiguous memory allocation, non- contiguous memory allocation technique, Virtual Memory Management - Demand Paging &amp; Page-Replacement Algorithms, Demand Segmentation. Thrashing, Cache memory organization, Locality of reference.</p>
<b>UNIT-V</b>	<p><b>FILE SYSTEMS</b>  File system Concepts, Disk scheduling Algorithms, File management – organization, Directories, file sharing, Record blocking, Secondary storage management, Disk Management- I/O Systems, System Protection and management.</p>

### **TEXT BOOKS**

1. William Stallings, “Operating Systems – internals and design principles”, Prentice Hall India, 10<sup>th</sup> Edition, 2018.
2. Design of the Unix Operating System By Maurice Bach, PHI. Andrew S. Tanenbaum, Herbert Bos, 5th Ed.
3. Silberschatz, Peter Galvin, “Operating System Concepts”, AWL 10th Edition, 2021.

### **REFERENCE BOOKS**

1. Andrew S. Tannenbaum & Albert S. Woodhull, “Operating System Design and Implementation”, Prentice Hall India, 2nd Edition, 2018.
2. Ida M. Flynn, Ann McIver McHoes, “Understanding Operating Systems”, 3rd Ed. (2017).
3. Gary Nutt, “Operating System - A Modern Perspective”, Pearson Education Asia, 2nd Edition 2000. Harvey M. Deitel, “Operating Systems”.

### **OPEN EDUCATION RESOURCES**

1. <https://pages.cs.wisc.edu/~remzi/OSTEP/>
2. <https://open.umn.edu/opentext>
3. <https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/>
4. <https://www.udacity.com/course/introduction-to-operating-systems--ud923>

<b>JAVA PROGRAMMING</b>	
Course Code: 25CS2010	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To understand and apply object-oriented programming principles using Java.</li> <li>2. To develop Java programs using inheritance, packages, and interfaces.</li> <li>3. To implement robust applications with exception handling and multithreading.</li> <li>4. To perform file handling, database interaction using JDBC, and utilize generics.</li> <li>5. To design and develop user-friendly Java applications using JavaFX, design patterns, and modern Java features such as the Stream API.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply Java programming constructs like classes, objects, and control structures.</li> <li>2. Construct reusable Java code using inheritance, abstract classes, and interfaces.</li> <li>3. Build multithreaded programs with proper exception management.</li> <li>4. Develop Java applications to handle files and databases using Java I/O and JDBC.</li> <li>5. Create interactive JavaFX applications using controls, event handling, layout managers, and apply design patterns and Stream API for efficient data processing.</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>CLO's CO's</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>		√			
<b>CO3</b>			√		
<b>CO4</b>				√	
<b>CO5</b>					√

**Mapped SDG: SDG-4, SDG-8, SDG-9**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<p><b>OOPs AND JAVA CONCEPTS</b> Overview of OOP - Object oriented programming paradigms, Features of Object-Oriented Programming. Introduction to Java Language - Characteristics of Java, Difference between C++ and Java, Data Types, Variables, Arrays, Operators, Control Statements, Programming Structures, Defining classes &amp; objects, Enumeration.</p> <p>Overloading Methods – Objects as Parameters, Returning Objects, Static, Nested and Inner Classes. Constructors, Inheritance - Types of Inheritance, Member Access Specifiers, Super keywords, Polymorphism - Method Overriding, Dynamic Method Dispatch, Abstract Classes.</p>
UNIT-II	<p><b>PACKAGES, INTERFACES, I/O, GENERICS &amp; STRING HANDLING</b> Packages – Packages and Member Access, Importing Packages. Interfaces - defining and interface, implementing interface, nested interface, Wrapper Classes.</p> <p>I/O Basics – Reading and Writing, Console I/O. Generic Programming –Classes &amp; methods, Bounded Types, Restrictions. Working with Files and Directories, Java NIO API, File Operations.</p>
UNIT-III	<p><b>EXCEPTION HANDLING AND MULTI-THREADING</b> Exception Handling, Multiple catch clauses, Nested try Statements, throw, throws, finally, Built-in Exceptions, User-defined Exception, Exception Handling in File Operations.</p> <p>Multithreaded Programming: Java Thread Model, creating a Thread, Life Cycle of a Thread, Multiple Threads, Thread Priorities, Synchronization, Inter Thread Communication, Difference between thread-based multi-tasking and process-based multitasking.</p>
UNIT-IV	<p><b>JAVA DATABASE CONNECTIVITY</b> Introduction to JDBC, JDBC Product, Types of Drivers, Two-Tier Client/Server Model, Three-Tier Client/Server Model, Basic Steps of JDBC, Creating and Executing SQL Statement, The Result Set Object, Working with Database Metadata, Connection Pool.</p> <p><b>CASE STUDY:</b> Student Record Management System - Design a system that performs basic file operations and database interactions to manage student academic records.</p>
UNIT-V	<p><b>JAVAFX EVENTS, CONTROLS AND COMPONENTS</b> JAVAFX Events and Controls, Event Basics – Handling Key and Mouse Events. Controls and Components - Checkbox, ToggleButton, RadioButtons, ListView, ComboBox, ChoiceBox, Text Controls, ScrollPane. Layouts – FlowPane, HBox, VBox, BorderPane, StackPane, GridPane. Menus Basics – Menu, Menu bars, MenuItem.</p> <p><b>CASE STUDY:</b> Online Course Feedback System - Build a simple JavaFX application that allows students to submit course feedback, view previous entries, and demonstrate modern Java features.</p>

**TEXT BOOKS**

1. C. S. Horstmann, \*Core Java, Volume I—Fundamentals\*, 12th ed. New York, NY, USA: Pearson, 2022.
2. H. Schildt, \*Java: The Complete Reference\*, 13th ed. New York, NY, USA: McGraw Hill Education, 2023.
3. K. Sierra, B. Bates, and T. Gee, \*Head First Java\*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022.

**REFERENCE BOOKS**

1. J. Bloch, \*Effective Java\*, 3rd ed. Upper Saddle River, NJ, USA: Addison-Wesley, 2018.
2. C. Walls, \*Spring in Action\*, 6th ed. Shelter Island, NY, USA: Manning Publications, 2022.
3. Sara Baase, "Computer Algorithms - Introduction to design and analysis", Pearson.

**OPEN EDUCATIONAL RESOURCES (OERs)**

1. Oracle, "The Java™ Tutorials: Learning the Java Language," \*Oracle\*, 2025. [Online]. Available: <https://docs.oracle.com/javase/tutorial/java/TOC.html>
2. Oracle, "Learn Java," \*Dev.java\*, 2025. [Online]. Available: <https://dev.java/learn/>  
(Note: The year reflects the current year as content is continuously updated.)
3. Duke University, "Java Programming and Software Engineering Fundamentals Specialization," \*Coursera\*, [Online]. Available: <https://www.coursera.org/specializations/java-programming>
4. CodeGym, "Java Online Course," \*CodeGym\*, 2025. [Online]. Available: <https://codegym.cc/>

## DISCRETE STRUCTURES

Course Code: 25CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVES

1. Apply principles of propositional and predicate logic to construct formal arguments and validate algorithms using inference and proof techniques.
2. Demonstrate understanding of sets, relations, and functions, and utilize them to describe and analyse mathematical and computational structures.
3. Use counting principles, permutations, combinations, recurrence relations, and generating functions to solve combinatorial problems and analyse algorithms.
4. Analyze and model real-world problems using graph theoretical concepts such as graph coloring, planarity, Eulerian and Hamiltonian paths.
5. Understand and apply algebraic structures and number theory concepts, including groups and modular arithmetic, in the context of cryptography and formal systems.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.
2. Relate the ideas of mathematical induction to recursion and recursively defined structures.
3. Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms.
4. Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.
5. Formalizes the sets with the binary operations.
6. Understand the application of number theory in cryptography.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓	✓				
CO2			✓			
CO3				✓	✓	
CO4						✓
CO5						

**Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-16**

## COURSE CONTENT

UNIT NUMBER	COURSE CONTENT
UNIT-I	<b>INTRODUCTION TO LOGIC</b> Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy, Mathematical Induction: examples, strong Induction, well ordering principle, invariants.
UNIT-II	<b>BASIC MATHEMATICAL STRUCTURES</b> <b>Sets</b> , definition, types of sets, Venn Diagram, using set notation with Quantifier, Set Operations, Set Identities and their proofs. Fuzzy sets. <b>Functions</b> , definition and properties, types of functions, comparing infinite sets using functions, countable and countably infinite sets. <b>Relation</b> : equivalence relations and partitions of a set, partial order relations, posets, Hasse diagram, chains, anti-chains, Lattices.
UNIT-III	<b>COUNTING TECHNIQUES</b> <b>Basic Counting Techniques</b> : product and sum principles, the bijection principle, division rule, double counting, Handshake lemma, Pascal's triangle, permutations and combinations with and without repetitions. <b>Advanced counting Techniques</b> : Sequences: Sum of sequences and product of sequences, estimating factorials, Counting techniques: Pigeon-hole principle (PHP), its variants and its application.
UNIT-IV	<b>GRAPH THEORY</b> Basic terminology, Konigsberg bridge problem, Types of graphs: ,Eulerian, Hamiltonian, Bipartite, Planar; Graph isomorphism and Homomorphism, Subgraphs, cliques and independent sets, large bipartite subgraphs, connected components, cut edges, Matchings, Perfect and maximum matchings.
UNIT-V	<b>ALGEBRAIC SYSTEMS &amp; NUMBER THEORY</b> <b>Algebraic systems</b> : Semigroup, Monoid, Groups, Abelian group, Cyclic Group, Subgroup, order of a group and subgroups, Lagrange's theorem, group isomorphism and homomorphism. <b>Number Theory</b> : Modular arithmetic and applications to cryptography; Chinese Remainder theorem.

### **TEXT BOOKS**

- Kenneth H. Rosen, Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill Education, 2019.
- C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics: A Computer-Oriented Approach, 4th Edition, McGraw Hill Education, 2020.
- N. L. Biggs, Discrete Mathematics, Revised Edition, Oxford University Press, 2002.
- Douglas B. West, Introduction to Graph Theory, 2nd Edition, Pearson Education, 2001. (Reprinted by PHI Learning Pvt. Ltd., Eastern Economy Edition)

### **REFERENCE BOOKS**

- J. A. Bondy and U. S. R. Murty, Graph Theory, Graduate Texts in Mathematics, Springer, 2008. (Reprint of the 2008 edition in 2013)
- J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Reprint Edition, McGraw Hill Education, 2017.
- Ronald L. Graham, Donald E. Knuth, and Oren Patashnik, Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Addison-Wesley, 1994.
- Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery, An Introduction to the Theory of Numbers, 5th Edition, Wiley India, 2008.
- G. H. Hardy and E. M. Wright, An Introduction to the Theory of Numbers, 6th Edition, Oxford University Press, 2008.

- Peter J. Cameron, Combinatorics: Topics, Techniques, Algorithms, Cambridge University Press, 1994. (Latest reprints available)
- J. H. van Lint and R. M. Wilson, A Course in Combinatorics, 2nd Edition, Cambridge University Press, 2001.
- Ralph P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson, 2003

#### **OPEN EDUCATIONAL RESOURCES (OER's)**

- Oscar Levin, Discrete Mathematics: An Open Introduction, 3rd Edition, 2023, Available at: <https://discrete.openmathbooks.org>
- Eric Lehman, F. Thomson Leighton, Albert R. Meyer, Mathematics for Computer Science, MIT OpenCourseWare, 2005, Available at: <https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2005/>
- Prof. Kamala Krithivasan, Discrete Structures, NPTEL Online Course, IIT Madras, Available at: <https://nptel.ac.in/courses/106106094>
- David Liben-Nowell, Discrete Mathematics, Carleton College, 2020, Available at: <https://cs.carleton.edu/faculty/dln/book/>

## OPERATING SYSTEMS LAB

Course Code: 25CS2114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

### COURSE OBJECTIVES

1. To understand the operating system principles and its implementations.
2. To understand the main components of an OS & their functions.
3. To provide necessary skills for developing and debugging programs in order to optimize performance of OS.
4. To study process management and scheduling.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Demonstrate the various operations of the file system.
2. Understand and Implement Memory management schemes, Thread and synchronization
3. Implement Deadlock algorithms and page replacement algorithms.
4. Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.
5. Implement Scheduling algorithms

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

CLO's CO's	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√	√	
CO4					√

**Mapped SDGs: SDG-4,SDG-9,SDG-11,SDG-12,SDG-16**

### LIST OF PROGRAMS

1. Implement CPU scheduling for first come first serve and shortest job first.
2. Implement priority scheduling and Round Robin Algorithms for CPU Scheduling.
3. Implementation of Demand Paging using Least Recently Used (LRU) Page Replacement Algorithm.
4. Implementation of Demand Paging using First in First Out (FIFO) Page Replacement Algorithm.
5. Implementation of Demand Paging using Optimal Page Replacement Algorithm.
6. Implement first fit, best fit and worst fit algorithms for Memory management.
7. Implementation of resource allocation graph (RAG)
8. Implement reader/writer problems using semaphore.
9. Implement the solution for Bounded Buffer (producer-consumer) problem using inter process communication techniques by Semaphores
10. Implement Banker's algorithm for deadlock avoidance.

**TEXT BOOKS**

1. Abraham Silberschatz Peter B. Galvin and Greg Gagne, Operating System Concepts,Wiley 10th Ed.
2. Garry. J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley
3. Andrew S. Tanenbaum and Herbert Bros, Modern Operating Systems (4th Edition), Pearson.

**REFERENCE BOOKS**

1. William Stallings, "Operating Systems - internals and design principles", Prentice Hall India, 9th ed., 2017.

**OPEN EDUCATIONAL RESOURCES (OER's)**

1. <https://www.geeksforgeeks.org/>
2. <https://pages.cs.wisc.edu/~remzi/OSTEP>
3. Visualization tools for page replacement

<b>JAVA PROGRAMMING LAB</b>	
Course Code: 25CS2116	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

### **COURSE OBJECTIVE**

1. To familiarize with the Java Environment and to implement OOP concepts.
2. To understand the concepts of interface and how to create new packages.
3. To learn how to create an interactive application.

### **COURSE LEARNING OUTCOME:**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Learn & practice the Object Oriented concepts like Inheritance, Overloading etc.
2. Learn & practice Interfaces and Packages.
3. Design and implement GUI Applications using AWT.
4. Provide Error handling and Detection facility to the application.

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

CLO's CO's	CLO1	CLO2	CLO3	CLO4
<b>CO1</b>	√			
<b>CO2</b>		√		
<b>CO3</b>			√	√

**Mapped SDGs: SDG-4,SDG-9**

### **LIST OF PROGRAMS**

1. WAP in Java illustrating various data types in Java.
2. WAP in Java illustrates class, objects and methods.
3. WAP to demonstrate the concept of Constructor -Default,parametrized,copy.
4. WAP in Java for addition and multiplication of Matrices.
5. WAP in Java illustrating the concept of Overloading.
6. WAP in Java to implement Single, Multilevel, and Hierarchical Inheritance using real world examples.
7. WAP in Java to demonstrate Runtime Polymorphism using method overriding with super keyword.
8. WAP to implement Exception Handling including multiple catch blocks, nested try, and finally.
9. WAP in Java to perform String manipulations using String Builder and String Tokenizer.
10. WAP to demonstrate the usage of Interfaces and Abstract Classes, with a real-world scenario like Bank or Shape.
11. WAP in Java to create and import User-defined Packages across multiple classes and folders.
12. WAP in Java to create and manage Threads using both Thread class and Runnable interface, including thread priorities.
13. 14.WAP to demonstrate File I/O in Java, reading and writing from/to files using FileReader,

BufferedReader, and FileWriter.

14. WAP in Java for illustrating the use of Autoboxing unboxing.

<b>Learning Resources</b>
<ol style="list-style-type: none"><li>1. Java: The Complete Reference, Ninth Edition Paperback by Herbert Schildt</li><li>2. The Java Handbook, by Patrick Naughton, Michael Morrison</li><li>3. Advanced Java Programming by Uttam K. Roy, Publisher: Oxford University Press</li><li>4. "Java: The Complete Reference" by Herbert Schildt, McGraw-Hill</li><li>5. "Programming with Java" by E. Balagurusamy, McGraw-Hill Education</li></ol>

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code: 25CS0202</b>	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
LT P : 0 0 2	
Credits: 1	

### TRAINING OBJECTIVES

1. To understand the need of AI.
2. To describe basic AI algorithms (e.g., standard search algorithms).
3. To learn about one of the learning methods of AI that is Machine Learning.
4. To identify potential application domains of AI and machine learning in practice.

### TRAINING LEARNING OUTCOMES (TLOS): -

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of training the students will be able to:

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2. Understands the basics and need of AI and Machine learning in a global view.
3. Understands, apply and evaluate the supervised learning techniques.
4. Design and implement the different applications using the concepts of AI and ML

### TRAINING LEARNING OUTCOME (TLO)-TRAINING OBJECTIVE (TO) MAPPING

	TLO1	TLO2	TLO3	TLO4
T01	√			
T02		√		
T03		√	√	
C04			√	√

**Mapped SDG Goals: SDG -4,SDG-8,SDG-9,SDG-17**

### TRAINING CONTENTS

MODULE	TRAINING CONTENTS	STUDENTS ENGAGEMENT ACTIVITY
<b>UNIT-I</b>	<b>INTRODUCTION:</b> Introduction to AI: Definitions, Historical foundations, Basic Elements of AI, Characteristics of intelligent algorithm, AI application Area.	Classification of AI Problems into AI task Domains
<b>UNIT-II</b>	<b>PROBLEM SOLVING:</b> Depth-first, breadth-first search, Problem Reduction, Constraint Satisfaction , Means-End Analysis.	Solving manually constraint satisfaction problem

<b>MODULE</b>	<b>TRAINING CONTENTS</b>	<b>STUDENTS ENGAGEMENT ACTIVITY</b>
<b>UNIT- III</b>	<b>INTRODUCTION TO MACHINE LEARNING</b> Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques.	Identification of ML Model based on Application
<b>UNIT- IV</b>	<b>CLASSIFICATION PROBLEM</b> Machine learning Algorithms for classification problem	Design decision trees
<b>UNIT- V</b>	<b>HANDS ON ACTIVITY :</b> Students will apply the methods learnt to design applications for a) Constraint Satisfaction Problem b) Robot Traversal c) Classification problems like COVID Detection, Spam classification etc.	Implement the given activity.

#### **Text Books**

1. Introduction to Machine Learning, E. Alpaydin. MIT Press
2. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill.

#### **Reference Books**

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron.
2. Artificial Intelligence and Machine Learning, Vinod Chandra S. S., Anand Hareendran
3. Machine Learning, T.M. Mitchell, Mc-Graw Hill
4. Stuart Russell, Peter Norvig, Artificial intelligence: A Modern Approach, Prentice Hall, Fourth edition, 2020

#### **Open Educational Resources (OERs)**

1. Journal of Machine Learning Research (JMLR).
2. AI Communications (IOS Press - Hybrid OA).

<b>LIVE PROJECT-I &amp; INDUSTRIAL VISIT</b>	
Course Code: 25CS0204	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

### **COURSE OBJECTIVE**

To provide hands-on experience at sites where Computer Science and engineering projects are executed.

### **COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather first-hand experience on sites.
2. Apply the concepts learnt to design and create an application.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>
<b>CO1</b>	√	√

### **LIVE PROJECT-I**

Students have to undergo three weeks practical training at the end of third semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

## SEMESTER - V

### COMPILER DESIGN

Course Code: 25CS3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVES

1. To introduce the major concept areas in compiler design and understand the structure of compilers.
2. To explore the working of lexical analysis, parsing, and syntax-directed translation.
3. To provide skills for intermediate code generation and effective use of symbol tables.
4. To impart knowledge of optimization techniques used in compilers for performance improvement.
5. To design efficient code generation strategies for target architectures.

#### COURSE LEARNING OUTCOMES (CLO)

The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Understand the structure and phases of a compiler including the tools used for development.
2. Apply lexical and syntax analysis techniques using tools.
3. Generate intermediate code and handle backpatching for control flow constructs.
4. Perform code optimization using basic block transformations and global data flow analysis.
5. Design and implement target code generation and perform optimization

#### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

COs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

Mapped SDGs: SDG-4, SDG-9, SDG-12

#### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Compilers</b> - Structure, Phases of a compiler ,Cousins of the Compiler,Grouping of Phases, Compiler construction tools - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Specification of Tokens, Lex specification.
UNIT-II	<b>Parsing Techniques</b> - Context-Free Grammars - Top-Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing -

UNIT NUMBER	COURSE CONTENTS
	Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser
UNIT-III	<b>Syntax Directed Translation</b> – Intermediate representations Intermediate languages - Back patching - Procedure calls and Declarations - Assignment Statements - Boolean Expressions - Case Statements
UNIT-IV	Introduction - Principal Sources of Optimization - Optimization of basic Blocks - DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis - Runtime Environments, Code Optimization, Basic Block formation – DAG for block optimization – Global data flow analysis – Runtime environments – Stack allocation – Parameter passing – Access to non-local names.
UNIT-V	<b>Code Generation</b> – Target machine model - - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG based code generation - Peephole Optimization- Register allocation and instruction selection.

### TEXT BOOKS

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: Principles, Techniques, and Tools, 2nd Edition, Pearson, 2020 (a.k.a. the "Dragon Book")
2. Keith D. Cooper and Linda Torczon Engineering a Compiler, 3rd Edition, Morgan Kaufmann, 2022

### REFERENCE BOOKS

1. Andrew W. Appel Modern Compiler Implementation in C (or Java, ML), Cambridge University Press, 2nd Ed. (latest reprint 2022)
2. Charles N. Fischer, Ron K. Cytron, Richard J. LeBlanc Jr. Crafting a Compiler, 2nd Edition, Pearson, 2022
3. Sridhar Iyer Compiler Design, Tata McGraw Hill, 2020

### Open educational Resources

1. MITOpenCourseWareCompilers(6.035),  
<https://ocw.mit.edu/courses/6-001-structure-and-interpretation-of-computer-programs-spring-2005/pages/lecture-notes/>
2. StanfordCS143:Compilers,  
<https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/>
3. NPTEL – Compiler Design (Prof. Partha Pratim Das / Prof. R. Ramasubramanian)  
<https://npTEL.ac.in/courses/106105190>

### Open Access Journals and Research Repositories

1. **Journal of Computer Languages (Elsevier)**  
<https://www.sciencedirect.com/journal/journal-of-computer-languages>
2. **ACM Digital Library (Access through institutional login)**  
<https://dl.acm.org>
3. **arXiv.org – Programming Languages (cs.PL)**  
<https://arxiv.org/list/cs.PL/recent>
4. **International Journal of Computer Applications (IJCA)**  
<https://www.ijcaonline.org/>
5. **"Crafting Interpreters" by Bob Nystrom (Free Online)**  
<https://craftinginterpreters.com/>
6. **Compiler Explorer (Godbolt)**  
<https://godbolt.org/>

<b>LIVE PROJECT-II &amp; INDUSTRIAL VISIT</b>	
Course Code: 25CS0303	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
LT P : 0 0 2	
Credits: 1	

### **COURSE OBJECTIVE**

To provide hands-on experience at sites where Computer Science and engineering projects are executed.

### **COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

3. Gather first-hand experience on sites.
4. Apply the concepts learnt to design and create an application.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

<b>CLOs</b>	<b>CLO1</b>	<b>CLO2</b>
<b>COs</b>		
<b>CO1</b>	√	√

### **MAPPED SDGs: SDG-4,SDG-8,SDG-9**

### **LIVE PROJECT-II**

Students have to undergo six weeks practical training at the end of fourth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

<b>COMPILER DESIGN LAB</b>	
Course Code: 25CS3117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Continuous Evaluation: 40 Marks	
End Semester Examination:60 Marks	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To be practically exposed to the compiler writing tools.</li> <li>2. To be able to design and analyze the compiler.</li> <li>3. To design a symbol table.</li> <li>4. To implement various Parsing techniques.</li> <li>5. To understand the basic steps for designing a compiler.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.</li> <li>2. Learn application of different compiler writing tools to implement the different Phases of compiler.</li> <li>3. Work on developing new computer languages in the industry and designing symbol tables.</li> <li>4. Design Top-down, Bottom-up parsing Techniques.</li> <li>5. Learn the process of translating a modern high-level language to executable code</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	✓				
<b>C02</b>		✓			
<b>C03</b>			✓		
<b>C04</b>				✓	
<b>C05</b>					✓

**Mapped SDG Goals: SDG -4,SDG-9, SDG-12, SDG- 17**

## LIST OF PROGRAMS

### 1. Lexical Analyzer Generator

Implement a lexical analyzer that identifies tokens (keywords, identifiers, operators) from a C source file and generates symbol table entries.

### 2. Operator Precedence Parser

Implement operator precedence parsing for arithmetic expressions with error handling for syntax violations.

### 3. Recursive Descent Parser

Build a recursive descent parser for a subset of the C language (if-else, while loops) with parse tree generation.

### 4. LR Parser Simulator

Simulate SLR parsing for grammar rules and display parsing tables with shift/reduce actions.

### 5. Syntax-Directed Translator

During parsing, convert infix expressions to postfix notation using syntax-directed translation.

### 6. Symbol Table Manager

Using hashing, Implement a hierarchical symbol table with scope management (insert, search, delete).

### 7. Intermediate Code Generator

Generate three-address code for control structures (if, for) with basic block identification.

### 8. DAG Optimizer

Construct a Directed Acyclic Graph (DAG) for basic blocks and eliminate common subexpressions.

### 9. Peephole Optimizer

Implement peephole optimization techniques (constant folding, strength reduction) on assembly-like code.

### 10. Register Allocator

Simulate graph-coloring register allocation for a set of virtual machine instructions.

### 11. Code Generator

Generate x86 assembly snippets from three-address code for arithmetic operations.

### 12. Error Recovery Mechanism

Implement panic-mode error recovery in a parser with meaningful error messages and line tracking.

## TEXT BOOKS

1. N. Sandler, Writing a C Compiler. San Francisco, CA, USA: No Starch Press, 2024.
2. S. Chattopadhyay, Compiler Design, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2022.
3. D. Thain, Introduction to Compilers and Language Design, 2nd ed. (Online Book), 2020/2021. Available: <https://www.compilerbook.com/>
4. Alfred V. Aho, Jeffrey D Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education Asia, 2012.

## REFERENCE BOOKS

1. Engineering a Compiler, Second Edition, Keith D. Cooper & Linda Torczon., Morgan Kaufmann, Elsevier.
2. Compiler Design, Sandeep Saxena, Rajkumar Singh Rathore, S.Chand Publications
3. T. Parr, The Definitive ANTLR 4 Reference. Raleigh, NC, USA: Pragmatic Bookshelf, 2013.

4. A. Møller and M. I. Schwartzbach, Static Program Analysis. Aarhus University, 2025. [Online]. Available: <https://cs.au.dk/~amoeller/spa/spa.pdf>

#### **ONLINE EDUCATIONAL RESOURCES**

1. Compiler Design (NPTEL - noc21\_cs07) S. Chattopadhyay, "Compiler Design," NPTEL, IIT Kharagpur. [Online]. Available: [https://onlinecourses.nptel.ac.in/noc21\\_cs07/preview](https://onlinecourses.nptel.ac.in/noc21_cs07/preview)
2. Compiler Design (NPTEL - 106104123) S. K. Aggarwal, "Compiler Design," NPTEL, IIT Kanpur. [Online]. Available: <https://nptel.ac.in/courses/106104123>
3. Computation Structures (MIT OpenCourseWare) C. Terman, "6.004 Computation Structures," MIT OpenCourseWare, Electrical Engineering and Computer Science, Spring 2017. [Online]. Available: <https://ocw.mit.edu/courses/6-004-computation-structures-spring-2017/pages/c11/>
4. 15-411 Compiler Design (Carnegie Mellon University) F. Pfenning, "15-411 Compiler Design," Carnegie Mellon University, Fall 2008. [Online]. Available: <https://www.cs.cmu.edu/~fp/courses/15411-f08/>

## PROGRAMMING USING MATLAB

Course Code: 25CS2115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

### TRAINING OBJECTIVES

1. To introduce MATLAB as a programming and computation platform for engineering tasks.
2. To apply MATLAB commands for matrix operations and logical computation.
3. To implement control structures and symbolic math in MATLAB.
4. To preprocess, import/export, and analyze engineering data using MATLAB.
5. To develop problem-solving skills through symbolic computation and equation solving

### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Apply basic MATLAB commands and arithmetic operations for numerical computations.
2. Develop MATLAB scripts using control structures (if-else, loops, switch).
3. Use symbolic computation features for differentiation, integration, and solving equations.
4. Perform data preprocessing and cleaning tasks using MATLAB's data-handling capabilities.
5. Import and export datasets using MATLAB for analysis and visualization.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√	√			
C02		√			
C03			√		
C04				√	√
C05	√	√	√	√	√

**MAPPED SDGs: SDG-4,SDG-9**

## LIST OF PROGRAMS

1. Fundamental MATLAB Commands.
2. To study basic Matrix Constructors and Operations.
3. To study basic Arithmetic operations.
4. To study basic Matrix operations.
5. Compare various Logical operators using MATLAB.
6. IF, Else and Else-if Comparison using MATLAB program.
7. Nested if and Switch statement using MATLAB program.
8. Loop condition of For and While using MATLAB program.
9. Implementation of symbolic variables using the MATLAB program.
10. Differentiation and Integration with symbolic variables using the MATLAB program.
11. Solving some Equations using the MATLAB program.
12. Symbolic Functions using the MATLAB program.
13. Data Import and Export.
14. Reading and writing data from/to files (CSV, Excel, text).
15. Importing data from external sources.
16. Data preprocessing and cleaning.
17. Working with tables and categorical data.

**Note: Students may be asked to create a small project to show the application of MATLAB programming.**

TEXT BOOKS
<ol style="list-style-type: none"><li>1. <b>Amos Gilat (2020)</b>, <i>MATLAB: An Introduction with Applications</i>, Wiley, 6th Edition.</li><li>2. <b>Rudra Pratap (2010)</b>, <i>Getting Started with MATLAB</i>, Oxford University Press, 2nd Edition.</li><li>3. <b>Stormy Attaway (2016)</b>, <i>MATLAB: A Practical Introduction to Programming and Problem Solving</i>, Elsevier, 4th Edition.</li><li>4. "MATLAB: A Practical Introduction to Programming and Problem Solving" by Stormy Attaway (4th Edition, 2016, Butterworth-Heinemann)</li></ol>
Open Educational Resources
<ol style="list-style-type: none"><li>1. <a href="https://www.mathworks.com/help/matlab/">https://www.mathworks.com/help/matlab/</a></li><li>2. <a href="https://matlabacademy.mathworks.com/details/matlab-onramp/getting-started">https://matlabacademy.mathworks.com/details/matlab-onramp/getting-started</a></li><li>3. <a href="https://ocw.mit.edu/courses/matlab-resources/">https://ocw.mit.edu/courses/matlab-resources/</a></li><li>4. <a href="https://www.youtube.com/user/MATLAB">https://www.youtube.com/user/MATLAB</a></li><li>5. <a href="https://www.coursera.org/learn/matlab">https://www.coursera.org/learn/matlab</a></li></ol>

## SEMESTER - VI

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM	
Course Code: 25CS3002	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE
<ol style="list-style-type: none"> <li>1. Introduce the foundational concepts, evolution, and core application areas of Artificial Intelligence (AI), including intelligent agents and their architectures.</li> <li>2. Develop the ability to model and solve real-world problems using search algorithms, adversarial game strategies, and constraint satisfaction techniques.</li> <li>3. Enable students to apply reasoning under uncertainty using probabilistic models, fuzzy logic, and knowledge representation frameworks.</li> <li>4. Equip learners with practical knowledge of AI-based planning, learning algorithms, and their implementation in autonomous and adaptive systems.</li> <li>5. Provide exposure to Natural Language Processing and expert systems, emphasizing industrial applications, ethical AI practices, and alignment with Sustainable Development Goals.</li> </ol>

COURSE LEARNING OUTCOMES (CLO)
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Explain the fundamental concepts of Artificial Intelligence, types of AI systems, and the role of intelligent agents.</li> <li>2. Apply appropriate search algorithms and game-playing strategies to model and solve AI problems.</li> <li>3. Analyze and implement reasoning under uncertainty using probabilistic models, fuzzy logic, and logic-based inference.</li> <li>4. Design AI systems using planning and learning approaches including supervised, unsupervised, and reinforcement learning.</li> <li>5. Develop applications using NLP techniques and expert systems, and evaluate their ethical implications and SDG alignment.</li> </ol>

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

CO	CLO	CLO1	CLO2	CLO3	CLO4	CLO5
C01		✓				
C02			✓			
C03				✓		
C04					✓	
C05						✓

**Mapped SDGs: SDG-4,SDG-9,SDG-3,SDG-10,SDG-16**

**COURSE CONTENT**

UNIT NUMBER	COURSE CONTENT
UNIT-I	<p><b>Foundations of AI and Intelligent Agents:</b>            Definition and History of AI, current trends and state-of-the-art systems, Types of AI: Reactive, Limited Memory, Theory of Mind, Self-aware AI, AI application areas: Healthcare, Finance, Robotics, Natural Language Processing, Autonomous Systems, AI Techniques: Machine learning, knowledge representation, search, Ethical Considerations: Bias in AI, Fairness, Transparency, Accountability, AI regulations and policies (e.g., GDPR, EU AI Act)  <b>Agents:</b> Definition of agents, PEAS description Agent architectures: Reactive, Layered, Cognitive, Multi-agent systems: Collaborating agents, Competitive agents.  <b>Case Studies:</b></p> <ul style="list-style-type: none"> <li>● AlphaGo (DeepMind): Reinforcement learning, deep neural networks, MCTS</li> <li>● GPT (OpenAI): Transformer architecture, large language models, NLP ethics</li> </ul>
UNIT-II	<p><b>Problem Solving and Search Algorithms</b>            Problem formulation and State-Space Representation, Uninformed Search Algorithms: BFS, DFS, Iterative Deepening, Informed Search Algorithms: Hill climbing, A*, Heuristics, Means-End Analysis, Stochastic search. Constraint satisfaction problem (CSPs): Backtracking, Forward checking, Adversarial Search: Game theory, Minimax, Alpha-Beta pruning.  <b>Case Study:</b></p> <ul style="list-style-type: none"> <li>● IBM Deep Blue: Heuristic search, pruning, and evaluation in chess AI</li> </ul>
UNIT-III	<p><b>Reasoning under Uncertainty and Knowledge Systems</b>            Monotonic Reasoning, Non-Monotonic Reasoning, Probabilistic Reasoning: Bayesian networks, Certainty factors, Fuzzy Logic: Membership functions, fuzzy rules  <b>Knowledge-Based Systems:</b> Facts, rules, and logical inference, Propositional Logic, First-Order Predicate Logic (FOPL), Clausal Form, Resolution, Unification algorithm. Knowledge representation: Semantic nets, frames, ontologies, rules, MYCIN Expert System: Rule-based reasoning, uncertainty handling in medical diagnosis.</p>
UNIT-IV	<p><b>Planning and Machine Learning:</b>  <b>Planning:</b> The blocks world, Components of Planning Systems, Goal stack Planning, Nonlinear planning, Hierarchical planning, Conditional planning,  <b>Learning paradigms:</b>, Supervised learning, unsupervised learning, Reinforcement learning, Inductive learning. Statistical learning, Neural networks: Perceptron (Single-layer, Multi-layer), Backpropagation  <b>Case Study:</b></p> <ul style="list-style-type: none"> <li>● Autonomous Vehicles (Tesla, Waymo): Real-time planning, deep RL, sensor fusion</li> </ul>
UNIT-V	<p><b>Natural Language Processing (NLP) and Expert Systems:</b>  <b>Natural Language Processing:</b> Language models, Text classification, Information retrieval, and Semantic analysis, Named Entity Recognition (NER), Machine Translation, Speech recognition, Image-text alignment, pattern recognition.  <b>Expert Systems:</b> Architecture and components (Inference engine, knowledge base, ES shells), Rule base and decision tree-based Expert systems, non-monotonic reasoning in Expert Systems, Communication interfaces (chatbots, decision support)  <b>Case Studies:</b> IBM Watson: NLP in healthcare, cancer diagnosis, question answering            AI in Education: Personalized tutoring systems, adaptive learning environments</p>

### TEXT BOOKS

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Fourth edition, 2020.
2. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill.

### REFERENCE BOOKS

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann, 1998.
3. Biere, A., Heule, M., Van Maaren, H., Walsh, T., Handbook of Satisfiability, IOS Press, 2009.
4. Judea Pearl, Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison- Wesley Publishing Company, 1984.
5. Pattern Recognition and Machine learning , C.M. Bishop, Springer
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning (ESL), Springer, 2009 (freely available online)
7. Kevin Murphy, Machine Learning: A Probabilistic Perspective (MLAPP), MIT Press, 2012
8. Artificial Intelligence and Expert Systems – Import, 28 April 2020 by I. Gupta (Author), G. Nagpal (Author)

### Open Educational Resources

1. **Stanford CS221: AI: Principles and Techniques**  
Free lecture slides and video overviews of AI history and agent software Engineering architectures.  
[🔗 CS221 Course Materials \(Stanford\)](#)
2. **MIT 6.034: Artificial Intelligence (Fall 2020)**  
Covers AI foundations, intelligent agents, PEAS models + in-depth agent work.  
[🔗 MIT OpenCourseWare – 6.034](#)

<b>SOFTWARE ENGINEERING</b>	
Course Code: 25CS3004	Continuous Evaluation: 40 Marks
Pre-Requisite : Concept of OOP and Methodology	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To introduce and implement Modern software process models (agile, scrum framework, sprint planning). AI transforms software development; DevOps integrates security into the development life cycle.</li> <li>2. To extract and analyze software requirements specifications for different projects.</li> <li>3. To develop the ability to design software systems using object-oriented principles, UML modelling, and architectural patterns.</li> <li>4. To understand and apply various software testing techniques, verification methods, and behavior-driven development practices.</li> <li>5. To evaluate software maintenance strategies, reliability issues, and deployment models used in real-world software systems.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Analyze software development process models, including agile models and traditional models like waterfall.</li> <li>2. Apply functional and non-functional requirement gathering techniques and estimate project cost using COCOMO or Agile metrics.</li> <li>3. Design software solutions using SOLID principles, UML diagrams, and appropriate architectural styles like MVC or micro services.</li> <li>4. Analyze and apply white-box and black-box testing strategies, including TDD and BDD, to ensure software correctness.</li> <li>5. Evaluate maintenance approaches, software reliability concepts and apply CASE Tools.</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	✓				
<b>C02</b>		✓			
<b>C03</b>		✓	✓		
<b>C04</b>			✓	✓	
<b>C05</b>					✓

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

## **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software life cycle models: Build and Fix Waterfall, Prototype, Iterative Enhancement Model, Evolutionary and Spiral model, V Model & RAD Model. Modern software process models (agile, scrum framework, sprint planning). AI transforms software development; DevOps integrates security into the development life cycle.
<b>UNIT-II</b>	<b>SOFTWARE REQUIREMENTS &amp; QUALITY ASSURANCE</b> Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model. Delphi and Basic COCOMO, Staffing Level Estimation, Staffing and sprint management. Introduction to agile roles: scrum master, product owner, developer.
<b>UNIT-III</b>	<b>SOFTWARE DESIGN CONCEPT</b> Basic Concept of Software Design, Architectural Design: MVC, Monolithic, Client-Server and micro-services. Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Abstraction, and Top-Down and Bottom-Up Design. Domain-driven design. Software Measurement and Metrics: Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs. SOLID principles, class and sequence diagrams using UML
<b>UNIT-IV</b>	<b>SOFTWARE TESTING</b> Software Testing: Testing functions, Test case design, White Box testing: cyclomatic complexity, Black box testing: Boundary value Analysis, Equivalence class partitioning, Unit testing, Integration Testing, System testing, Alpha Testing, Beta Testing and Acceptance Testing. Automation tools like Selenium. Introduction to TDD (test driven development), BDD (Behaviour-Driven Development).
<b>UNIT-V</b>	<b>SOFTWARE MAINTENANCE &amp; RELIABILITY ISSUES</b> Need for Maintenance, Categories of Maintenance, The Maintenance Process, Maintenance Models: Quick fix, Iterative Enhancement, Reuse Oriented. Reverse Engineering, Software RE-engineering, Configuration Management. Software Reliability: Failure and Faults, Software reliability Vs Hardware reliability, Classification of Failures, Software reliability metrics. CASE tools.

**TEXT BOOKS**

1. Richard Fairley, "Software Engineering Concepts", 1st edition, McGraw Hill, 2017.
2. Eric Evans, "Domain-Driven Design", 1st edition, Addison-Wesley Professional, 2003.
3. Robert Martin, "Agile Software Development, Principles, Patterns, and Agile Software Development, Principles, Patterns, and Practices", 1st edition, Pearson, 2002.
4. Roger S. Pressman, "Software Engineering A Practitioner Approach", 4<sup>th</sup> edition, McGraw Hill, 1999.
5. Erich Gamma, Richard Helm, Ralph Johnson, "Design Patterns: Elements of Reusable Object- Oriented Software", 1st edition, Addison-Wesley Professional, 1994.

**REFERENCE BOOKS**

1. Rubin Kenneth S. "Essential Scrum: A Practical Guide to the Most Popular Agile Process", 1st edition, Addison-Wesley Professionals, 2012.
2. Fundamentals of Software Engineering by Rajib Mall, -PHI-3rd Edition, 2009.
3. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.
4. Pankaj Jalote-An Integrated Approach to Software Engineering, Springer Verlag, 1997.
5. Shooman, Software Engineering, McGraw Hill, 1983.

**OPEN EDUCATIONAL RESOURCES**

1. [Software Engineering Tutorial – Geeks for Geeks](#)
2. [https://medium.com/towards-data-engineering/software-engineering-list-of-concepts-t  
ools-sectors-and-learning-resources](https://medium.com/towards-data-engineering/software-engineering-list-of-concepts-tools-sectors-and-learning-resources).
3. [Top Software Architecture Courses Online - Updated \[July 2025\]](#).
4. [Software Testing Techniques – Geeks for Geeks](#)
5. [15 Free Software Engineering Courses & Certificates 2025](#)
6. [https://www.bing.com/videos/riverview/relatedvideo?q=software+maintenance+open+s  
ources+for+learning+&mid](https://www.bing.com/videos/riverview/relatedvideo?q=software+maintenance+open+s<br/>ources+for+learning+&mid)
7. <https://www.bing.com/videos/riverview/relatedvideo?q=software+maintenance+open+s>

<b>BIG DATA ANALYTICS</b>	
Course Code: 25CS3012	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### **COURSE OBJECTIVE**

1. To understand the fundamentals of big data concepts, architectures, and its growing importance in real-world applications.
2. To apply statistical and inferential techniques to analyze structured and unstructured datasets.
3. To explore modern data visualization tools and techniques for meaningful representation of big data.
4. To introduce OLAP, data mining, and knowledge discovery approaches for decision-making support.
5. To design and implement big data solutions using Hadoop ecosystem and distributed computing tools.

### **COURSE LEARNING OUTCOME (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. To Explain the characteristics, challenges, and application domains of big data along with scalable analytics architectures.
2. To Apply descriptive and inferential statistical techniques to perform data analysis and hypothesis testing on large datasets.
3. To Design and evaluate data visualizations using tools like IBM Cognos or modern alternatives such as Tableau or Power BI.
4. To Analyze large datasets using OLAP and knowledge discovery algorithms for classification, clustering, and association.
5. To Develop and deploy distributed data processing solutions using Hadoop and MapReduce, and manage the Hadoop ecosystem.

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	✓				
<b>C02</b>		✓			
<b>C03</b>			✓		
<b>C04</b>				✓	
<b>C05</b>					✓

**Mapped SDGs: SDG-4,SDG-8,SDG-9**

## COURSE CONTENTS

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Big Data and its importance, Four V's, Extended 4 to 6V's , Drivers for Big data, Big data analytics, and Big data applications. Algorithms using map reduce, Real life examples of Map reduce e-commerce (e.g., Amazon), transportation (e.g., Uber), banking.
<b>UNIT-II</b>	<b>STATISTICAL ANALYSIS</b> Basic Statistics, Descriptive Statistics, Frequency Distributions, Histograms, Shapes of Distributions, Measures of Central Tendency Computing the Mean, Measuring Variability, Measures of Relationship, Regression, Reliability Indices, Standard Scores (Z scores), Inferential Statistics, Populations and Samples. The Null Hypothesis, Chi-Square and T Test, Statistical Decisions, Making Process, Testing for Mean Differences, Basic Hypothesis Testing in Python/R <b>Case Study:</b> Customer segmentation using statistical clustering.
<b>UNIT-III</b>	<b>DATA VISUALIZATION</b> Meaning and significance, Traits of Meaningful Data, Interactive Dashboards and Real-time Reporting, Power of visual perception, Making abstract data Visible, Building Blocks of information Visualization. Analytical Techniques, Using IBM Cognos for understanding data visualization. <b>Case Study:</b> Using IBM Cognos to visualize airline delays or retail sales.
<b>UNIT-IV</b>	<b>OLAP</b> Big Data, In-Memory Processing, limitations of In Memory Processing. Big Data Privacy, Big data Visualization, OLAP and its applications, Data Mining Process, Association Rule Mining, Clustering and Classification, Knowledge Discovery, Decision Support Systems.
<b>UNIT-V</b>	<b>APACHE HADOOP</b> Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce, Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

### **TEXT BOOKS**

1. Viktor Mayer-Schönberger & Kenneth Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think, Houghton Mifflin Harcourt, 2013.
2. Big Data: Concepts, Technology and Architecture – Balusamy et al., Wiley, 2021.

### **REFERENCE BOOKS**

1. Matter, U. Big Data Analytics: A Guide to Data Science Practitioners Making the Transition to Big Data ,Chapman & Hall/CRC,2023
2. Frank J. Ohlhorst, Big Data Analytics: Turning Big Data into Big Money, Wiley, 2012.

### **OPEN EDUCATIONAL RESOURCES**

1. Big Data Computing – NPTEL, Prof. Rajiv Misra (IIT Patna).
2. Big Data 101 – IBM Cognitive Class.

<b>ARTIFICIAL INTELLIGENCE LAB</b>	
Course Code: 25CS3114	Continuous Evaluation: 60 Marks
Pre-Requisite : Basics of any Programming Language	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To provide hands-on experience in implementing fundamental Artificial Intelligence algorithms.</li> <li>2. To enable students to develop search techniques, reasoning systems, and learning models through practical assignments, and to bridge the gap between theoretical knowledge of AI and its real-world applications.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Implement various search algorithms and problem-solving agents.</li> <li>2. Design knowledge representation models and demonstrate reasoning capabilities.</li> <li>3. Develop and evaluate machine learning models including neural networks and reinforcement learning agents.</li> <li>4. Apply Artificial Intelligence concepts to solve real-world and domain-specific problems.</li> <li>5. Demonstrate proficiency in AI tools and programming environments.</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>CLO CO</b>	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

**Mapped SDGs: SDG-4,SDG-3,SDG-9,SDG-10,SDG-12**

## LIST OF PROGRAMS

1. Install and configure Python, Jupyter Notebook, and required AI libraries.
2. Write a program to implement a rule-based problem-solving agent for a toy domain (e.g., vacuum cleaner world).
3. Write a program to perform Breadth-First Search (BFS) and Depth-First Search (DFS) for solving puzzles like the 8-puzzle.
4. Write a program to solve a pathfinding problem using the A algorithm.\*
5. Design and demonstrate a backtracking-based solution for the map-coloring or Sudoku problem.
6. Write a program to implement the minimax algorithm with alpha-beta pruning for a tic-tac-toe game.
7. Design and demonstrate a knowledge base in propositional logic and test reasoning queries.
8. Write a program to represent family relationships in First-Order Logic and apply unification techniques.
9. Design and demonstrate probabilistic reasoning using a basic Bayesian network.
10. Write a program for planning using state-space search for block world or a simple logistics domain.
11. Design and demonstrate a supervised learning program using a decision tree classifier on a sample dataset.
12. Write a program to train a feed-forward neural network to classify simple data (e.g., digits).
13. Design and demonstrate a reinforcement learning agent using Q-learning for a grid-world environment.
14. Students will demonstrate their own AI-based mini-project applying any techniques from previous experiments.

### Note:

- Students can choose any programming language for implementation like Python, C, C++, Java, MATLAB etc. (R programming, Python, Julia, Lisp, Mojo, Wolfram Language) tools are Cloud Translation API, Midjourney, Chatsonic, DALL-E 3, SlidesAI etc.
- Students will create a project in teams to analyse and apply the concepts learnt.

Open Educational Resources
<ol style="list-style-type: none"><li>1. Basics of Python, functions, data structures, Link: Python for Everybody (Coursera)</li><li>2. Code Repository (Based on "Artificial Intelligence: A Modern Approach") AIMA Python GitHub Repo</li><li>3. Supervised learning, overfitting, neural nets, etc. Link: Google Machine Learning Crash Course</li></ol>

Learning Resources	
<b>Reference Book and other materials</b>	<ol style="list-style-type: none"><li>1. Laboratory Manual</li><li>2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Fourth edition, 2020.</li><li>3. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill.</li></ol>

<b>SOFTWARE ENGINEERING LAB</b>	
Course Code: <b>25CS3118</b>	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits:1	

### **COURSE OBJECTIVES**

1. To understand the concepts and implement the software engineering methodologies in the list of applications given below. Each UML diagram is designed to let developers and customers view a software system from a different perspective and in varying degrees of abstraction. UML diagrams commonly created in RSA visual modeling tools.
2. To have hands-on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.
3. To Understand the User requirements through different software design components like DFD's, ER Diagram, Activity Diagram, Class Diagram, State Transition Diagram and Deployment Diagram etc.
4. To understand the concepts of SDLC Models like waterfall model, spiral model, prototyping model and Agile model specially.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Able to prepare SRS document, design document, test cases and software configuration management and risk management related documents.
2. Ability to translate end-user requirements into system and software requirements.
3. Understand and develop various structure and behavior UML diagrams
4. Develop function oriented and object oriented software design using tools like rational rose, Umbrello and free on-line tools like Star umbrello and Visual Paradigm.
5. Generate a high-level design of the system from the software requirements

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	✓				
<b>C02</b>		✓			
<b>C03</b>		✓	✓		
<b>C04</b>			✓	✓	
<b>C05</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>

**Mapped SDGs: SDG-4,SDG-9,SDG-11,SDG-16**

## LIST OF EXPERIMENTS

### Structure Diagram:

1. To display a relationship among the various structures using a Class diagram.
2. Manifestation concept of Component Diagram.
3. Network architect process using the Deployment Diagram.

### Behavior Diagram:

1. Use-Case Diagram–To display the relationship among actors & Use-cases.
2. Activity Diagram–To display the action states & source transition states.
3. State Machine Diagram– sequence of state response & action on the interaction.

### Interaction Diagram:

1. Sequence Diagram – To display the time sequence of object interactions.
2. Communication Diagram – To display the elements of frame, lifeline, messages.

### Case Study:

1. UML interaction overview diagram for online shopping.
2. Bank ATM behavioral using state machine diagram.
3. Library Domain model using Class diagram.

TEXT BOOKS
<ol style="list-style-type: none"><li>1. Roger S. Pressman, "Software Engineering A Practitioner Approach" 4<sup>th</sup> edition, McGraw Hill, 1999.</li><li>2. Software Engineering-Sommerville,7<sup>th</sup>edition,PearsonEducation</li><li>3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education</li></ol>
REFERENCE BOOKS
<ol style="list-style-type: none"><li>1. Ian Somerville, Software engineering, Pearson education Asia, 6<sup>th</sup> edition, 2000.</li><li>2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.</li><li>3. Software Engineering principles and practice-Waman S Jawadekar</li></ol>
OPEN EDUCATIONAL RESOURCES
<ol style="list-style-type: none"><li>1. <a href="https://staruml.io/">https://staruml.io/</a></li><li>2. <a href="https://plantuml.com/">https://plantuml.com/</a></li><li>3. <a href="https://www.geeksforgeeks.org/system-design/tools-for-designing-and-drawing-uml-diagrams/">https://www.geeksforgeeks.org/system-design/tools-for-designing-and-drawing-uml-diagrams/</a></li><li>4. <a href="https://www.visual-paradigm.com/VPGallery/import/Rose.html">https://www.visual-paradigm.com/VPGallery/import/Rose.html</a></li><li>5. <a href="https://apps.kde.org/umbrello/">https://apps.kde.org/umbrello/</a></li></ol>

<b>LIVE PROJECT-III &amp; INDUSTRIAL VISIT</b>	
Course Code: 25CS0304	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

### **COURSE OBJECTIVE**

- To provide hands-on experience at sites where Computer Science and engineering projects are executed.

### **COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP).

After the completion of course the students will be able to:

- Gather first-hand experience on sites.
- Apply the concepts learnt to design and create an application.

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES**

	<b>CLO1</b>	<b>CLO2</b>
<b>CO1</b>	√	√

### **LIVE PROJECT-III**

Students have to undergo three weeks practical training at the end of fifth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated

## SEMESTER – VII

### CLOUD COMPUTING

Course Code: 25CS4003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVES

1. To interpret the types and service models of any given cloud platform.
2. To assess the comparative advantages and disadvantages of Virtualization technology.
3. To offer the appropriate cloud computing solutions based on the application requirements.
4. To analyse and reveal the core issues in line with the security, privacy, and interoperability in cloud platforms.
5. To create a cloud environment using open source software tools.

#### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
2. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
3. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
4. Analyze various cloud programming models and apply them to solve problems on the cloud.
5. Enable students exploring some important cloud computing driven commercial systems and applications.
6. Expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

#### MAPPING BETWEEN COURSE OBJECTIVES (COS)AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

Mapped SDGs: SDG-4,SDG-9,SDG-11,SDG-12,SDG-16

## COURSE CONTENTS

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Cloud computing history, architecture and essential characteristics, cloud service models, Cloud Deployment models, advantages of cloud computing, cloud v/s grid computing.
<b>UNIT-II</b>	<b>VIRTUALIZATION</b> Virtualization techniques, Benefits and drawbacks of virtualization, VM migration with its types, hypervisors, types of hypervisors, distributed management of virtual infrastructures, scheduling techniques for advance reservation of capacity, Service-oriented architectures, SOAP v/s REST.
<b>UNIT-III</b>	<b>CLOUD APPLICATION DEVELOPMENT</b> <b>Cloud-Native Development:</b> Principles of Cloud-Native Applications, Microservices Architecture, DevOps and Continuous Integration/ Continuous Deployment (CI/CD). <b>Developing with IaaS and PaaS:</b> Setting Up Development Environments, Utilizing Cloud SDKs and APIs, Deployment Strategies. <b>Database Services:</b> Managed Databases (SQL, NoSQL), Database Migration, Performance Optimization. <b>Application Scaling and Monitoring:</b> Auto-Scaling, Load Testing, Monitoring and Logging. <b>Serverless Architecture:</b> Introduction to Serverless, Building and Deploying Serverless Applications, Use Cases and Best Practices
<b>UNIT-IV</b>	<b>MIGRATING INTO THE CLOUD:</b> Introduction, challenges in the cloud, legal issues in cloud computing, Cloud Economics and Capacity Management: Restricted Choices, Capacity Planning, Queuing and Response Time, Evidence Based Decision Making, Instrumentation (Measuring Resource Consumption), Bottlenecks, Key Volume Indicators.
<b>UNIT-V</b>	<b>CLOUD SECURITY</b> Security in clouds, protocols, algorithms, Security as a service, Tools and technologies to secure the data in Private and Public Cloud Architecture. Security Concerns, Legal issues and Aspects, Multi-tenancy issues Multi-cloud.

### **TEXT BOOKS**

Cloud Computing Principles and Paradigms, Rajkumar Buyya, Wiley & Sons Pub, 1<sup>st</sup> Edition, ISBN: 978-0-470-88799-8.

Cloud Computing Web-Based dynamic IT services: Christian Baun, 1<sup>st</sup> Edition, Springer.

Barrie Sosinky, Cloud Computing: Bible, 1st edition, Wiley Publishing, Inc., 2011.

### **REFERENCE BOOKS/OER:**

1. Syed A.Ahson and Mohammed Ilyas, Cloud Computing and Software Services: Theory and Techniques, CRC Press, Taylor and Francis Group, 2010, 3<sup>rd</sup> Edition global.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Cloud Computing for

Dummies.Wiley- India edition, 2010
3. NPTEL. <i>Cloud Computing</i> . IIT Madras / IIT Kanpur. <a href="https://onlinecourses.nptel.ac.in/noc21_cs39/preview">https://onlinecourses.nptel.ac.in/noc21_cs39/preview</a> .
4. MIT OpenCourseWare. <i>Cloud Computing</i> . Massachusetts Institute of Technology. <a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-824-distributed-computer-systems-engineering-fall-2003/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-824-distributed-computer-systems-engineering-fall-2003/</a> .
5. Gupta, Indranil, instructor. <i>Cloud Computing Concepts</i> . Coursera. <a href="https://www.coursera.org/learn/cloud-computing">https://www.coursera.org/learn/cloud-computing</a> .

<b>OPEN EDUCATIONAL RESOURCES</b>
1. NPTEL Video Lectures – Cloud Computing by IIT Kharagpur 2. Cloud Computing Concepts – University of Illinois (Coursera – Audit Free) 3. MIT OpenCourseWare – Introduction to Cloud

## WEB APPLICATION DEVELOPMENT

Course Code: 25CS4005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVES

1. Understand the structure and protocols of the modern web including HTML5, HTTP, and client-server architecture.
2. Apply CSS and JavaScript to build interactive, responsive, and dynamic user interfaces for web applications.
3. Develop modular and reusable frontend components using modern JavaScript frameworks like React.
4. Design and implement RESTful backend services using Node.js, Express, and connect them with databases like MongoDB.
5. Deploy full-stack web applications using cloud platforms and integrate version control, testing, and CI/CD practices for maintainability.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Create structured HTML5 web pages that incorporate forms, multimedia, and semantic elements.
2. Style and layout web content using CSS (Flexbox, Grid, Media Queries), and implement interactivity using JavaScript and DOM manipulation
3. Build scalable single-page applications (SPAs) using React, manage state using hooks, and navigate using React Router.
4. (*Apply/Create*)Construct and consume RESTful APIs using Express.js and Node.js, perform CRUD operations, and integrate MongoDB for persistent storage.
5. Use Git and GitHub for version control, write unit tests, configure build tools, and deploy full-stack applications using platforms like Heroku or Netlify

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-11,SDG-12**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<p><b>Web Fundamentals and HTML5</b> <b>The Internet and Web Technologies:</b> Internet vs. WWW, Web Browsers, Web Servers, HTTP/HTTPS Protocol, MIME types, DNS, URL structure, Web Security Basics: HTTPS, SSL/TLS, Secure Headers, Cookies vs. Local Storage, CORS <b>HTML Basics:</b> HTML Syntax, Structure of an HTML Document, Tags, Attributes, Elements, Text and Media Elements: Headings, Paragraphs, Lists, Links, Anchors, Images, Audio, Video, <b>Forms and User Input:</b> Input types, textarea, select, button, form attributes, client-side validation <b>HTML5 Advanced Features:</b> Semantic Elements (header, footer, section, article), Forms, Canvas and SVG Graphics.</p>
UNIT-II	<p><b>CSS and JavaScript</b> <b>CSS Fundamentals:</b> Syntax, Selectors, Property-Value Pairs, Inline/Embedded/External CSS, Layout and Design: Box Model, Positioning, Flexbox, Grid Layout, Backgrounds, Fonts, Lists, Borders, Pseudo-classes, Responsive Design: Media Queries, Viewport, Mobile-First Design Principles <b>JavaScript Essentials:</b> Syntax, Variables, Data Types, Operators, Control Structures, Functions, Arrays, Objects and Events: Object Creation, Event Handling, Regular Expressions, Error Handling, Modern JavaScript: ES6+ Features (let, const, arrow functions, template literals, destructuring).</p>
UNIT-III	<p><b>DOM Manipulation and Frontend Frameworks</b> <b>JavaScript and the DOM:</b> DOM Tree, Selecting Elements (getElementById, querySelector), Changing Content/Styles, Event Listeners, Form Handling and Validation: Capturing Input, Real-Time Validation, Preventing Submission, <b>React Basics:</b> What is React? JSX, Virtual DOM, Component-Based Architecture, React Components: Functional vs Class Components, Props and State, Lifecycle Methods, Hooks in React: useState, useEffect, Creating Custom Hooks, Routing and Navigation: React Router Basics, Route Params, Link and NavLink, State Management: Context API, Introduction to Redux (optional)</p>
UNIT-IV	<p><b>Backend Development with Node.js and Express</b> <b>Node.js Introduction:</b> What is Node.js?, Non-blocking I/O, Event Loop, npm and Modules, Core Node Modules: File System, Path, OS, HTTP Module, Express.js Framework: Routing, Middleware, Request and Response Handling, Building RESTful APIs: CRUD Operations, JSON Handling, RESTful Design, Database Integration: MongoDB Basics, Mongoose ODM, Connecting and Querying, Authentication &amp; Security: Sessions vs JWT, bcrypt, Helmet, Rate Limiting, Advanced Topics: Error Handling, Logging, Environment Variables, Real-Time Apps with <a href="#">Socket.io</a> <b>Deployment:</b> Hosting Node Apps (Heroku, Render, AWS EC2)</p>

UNIT NUMBER	COURSE CONTENTS
UNIT-V	<p><b>Full-Stack Development, DevOps, and Deployment</b></p> <p><b>Full-Stack App Architecture:</b> Connecting React (Frontend) with Express/MongoDB (Backend), Project Structuring: Folder Structure, API Design Patterns, MVC Concepts, Version Control with Git: Git Basics, Branching, Merging, GitHub Collaboration, Pull Requests, Testing and Debugging: Unit Testing with Jest and Mocha, API Testing with Postman, Debugging Tools, Build Tools and Optimization: Webpack, Babel, Tree Shaking, Code Splitting, Lazy Loading, Task Automation: npm Scripts, Gulp (optional). Deployment and CI/CD: Preparing Production Builds, Hosting on Netlify, Vercel, Heroku; GitHub Actions, Continuous Integration, Environment Management, Performance Monitoring: Lighthouse, LogRocket, Sentry (overview).</p>

TEXT BOOKS
<ol style="list-style-type: none"> <li>1. Programming the World Wide Web – Robert W. Sebesta, 8th Edition, Pearson Education</li> <li>2. Internet &amp; World Wide Web How to Program – M. Deitel, P. J. Deitel, A. B. Goldberg</li> <li>3. Eloquent JavaScript – Marijn Haverbeke (Open Source)</li> <li>4. Learning React – Alex Banks and Eve Porcello, O’Reilly Media</li> </ol>
REFERENCE BOOKS
<ol style="list-style-type: none"> <li>1. MDN Web Docs – <a href="https://developer.mozilla.org">https://developer.mozilla.org</a></li> <li>2. React Official Docs – <a href="https://reactjs.org">https://reactjs.org</a></li> <li>3. Node.js Docs – <a href="https://nodejs.org">https://nodejs.org</a></li> <li>4. Express.js Guide – <a href="https://expressjs.com">https://expressjs.com</a></li> <li>5. FreeCodeCamp Curriculum – <a href="https://www.freecodecamp.org">https://www.freecodecamp.org</a></li> <li>6. GitHub Docs – <a href="https://docs.github.com">https://docs.github.com</a></li> </ol>
OPEN EDUCATION RESOURCES
<ol style="list-style-type: none"> <li>1. <i>Eloquent JavaScript</i> – Marijn Haverbeke (Free Access): <a href="https://eloquentjavascript.net">https://eloquentjavascript.net</a></li> <li>2. <i>Learning React</i> – Alex Banks &amp; Eve Porcello (<i>for deep dives – not OER, but often available through institutional access</i>)</li> </ol>

<b>CLOUD COMPUTING LAB</b>	
Course Code: 25CS4113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
LT P : 0 0 2	
Credits: 1	

### **COURSE OBJECTIVES**

1. To analyse and reveal the core issues in line with the security, privacy, and interoperability in cloud platforms.
2. To apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost.
3. To study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.
4. To assess the comparative advantages and disadvantages of Virtualization technology.
5. To create a cloud environment using open source software tools.
6. To analyze various cloud programming models and apply them to solve problems on the cloud.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Explain the fundamental principles of cloud computing and its related concepts.
2. Analyze Prominent Cloud computing technologies available in the marketplace.
3. Discuss virtualization technologies along with the architectural models of cloud computing.
4. Leverage the prominent Cloud computing technologies available in the market place.
5. Demonstrate different features of cloud platforms used in Industry.
6. Understand how energy efficiency is achieved in cloud computing using green computing and understand the mechanism needed to harness cloud computing in the respective endeavours.
7. Apply suitable applications to leverage the strength of cloud computing.
8. Develop the applications of cloud Computing that can harness the power of cloud computing.

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>	<b>CLO7</b>	<b>CLO8</b>
<b>C01</b>	√	√						
<b>C02</b>		√	√					
<b>C03</b>			√	√				
<b>C04</b>				√				
<b>C05</b>					√	√		
<b>C06</b>							√	√

**Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-12,SDG-17**

## LIST OF PROGRAMS

1. To **Install and manage** virtual machines using latest **VirtualBox 7.x** or **GNOME Boxes** on open-source Linux OS (Ubuntu/Fedora) with guest OS configurations for development.
2. To implement Infrastructure as a Service, Installing OpenStack and use it as Infrastructure as a Service.
3. To install Storage as Service. [Installation and understanding features of ownCloud as SaaS.]
4. To implement identity management. [installing and using identity management features of OpenStack].
5. To write a program for web feeds [ PHP, HTML].
6. To simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
7. To install Hadoop single node cluster and run simple applications like wordcount.
8. To find a procedure to transfer the files from one virtual machine to another virtual machine.
9. To Install Google App Engine. Create a hello world app and other simple web applications using python/java.
10. To demonstrate the usage of Google Drive as a cloud-based productivity tool for creating, editing, and sharing spreadsheets and notes in real-time.
11. To demonstrate the development and execution of programs in multiple programming languages using a cloud-based IDE environment. Working in Cloud9 to demonstrate different languages.
12. To demonstrate how websites are provisioned, deployed, and scaled using a cloud-based development platform.
13. To configure a single-node Hadoop cluster for data processing tasks.

**Tools Used:** Hadoop (Apache Hadoop – Open Source), Ubuntu/Debian Linux VM

**Note:** At least 5 to 10 more exercises to be given by the teacher concerned.

### TEXT BOOKS

1. Cloud Computing-A Practical Approach” Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw-Hill.
2. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O’ReillyMedia Inc
3. Barrie Sosinky, Cloud Computing: Bible, 1st edition, Wiley Publishing, Inc., 2011.
  - a. Cloud Computing: A Practical Approach, Velte et al., McGraw-Hill, 2009
  - b. Cloud Security and Privacy, Tim Mather et al., O’Reilly Media, 2009
  - c. Cloud Computing: From Beginning to End, Ray J. Rafaels, CRC Press, 2nd Ed., 2021

### REFERENCE BOOKS

1. Cloud Computing for Dummies, Judith Hurwitz et al., Wiley, 2nd Ed., 2013
2. Cloud Computing and Software Services, Ahson & Ilyas, CRC Press, 2010
3. Cloud Computing: Principles, Systems and Applications, Antonopoulos & Gillam, Springer, 2nd Ed., 2017
4. Hybrid Cloud for Dummies, Judith Hurwitz et al., Wiley, 2021.

### Open Educational Resources (OERs)

1. NIST Cloud Computing Guide:  
<https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>
2. Open Textbook (Cloud Architecture): <https://opentextbc.ca/cloudcomputing/>
3. Coursera (IBM – Intro to Cloud):  
<https://www.coursera.org/learn/introduction-to-cloud>
4. Microsoft Azure Learn:  
<https://learn.microsoft.com/en-us/training/paths/azure-fundamentals/>
5. Google Qwiklabs: <https://www.cloudskillsboost.google/>
6. AWS Training: <https://www.aws.training>

<b>LIVE PROJECT-III &amp; INDUSTRIAL VISIT</b>	
Course Code: 25CS4115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

**COURSE OBJECTIVE**

To provide hands-on experience at sites where Computer Science and engineering projects are executed.

**COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP).

After the completion of course the students will be able to:

1. Gather first-hand experience on sites.
2. Apply the concepts learnt to design and create an application.

**MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>
<b>CO1</b>	√	√

**MAPPED SDGs: SDG-4, SDG-8, SDG-9**

**LIVE PROJECT-IV**

Students have to undergo six weeks practical training at the end of sixth semester in Computer Science and Engineering related project sites or with the faculty members of parent or any other institute of repute. At the end of the training they have to submit a report together with a certificate in the format prescribed and make a power point presentation which shall be evaluated.

<b>MINOR PROJECT</b>	
Course Code: 25CS4117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 8	
Credits: 4	

### **COURSE OBJECTIVE**

To simulate real life situations related to Computer Science and engineering and impart adequate training so that confidence to face and tackle any problem in the field is developed.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Identify, formulate and analyse existing problems in the (non-automated) work flow for performing a specific task.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.
5. Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

### **MAPPING BETWEEN COURSE OBJECTIVES (CO) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√	√	√	√	√

**MAPPED SDGs: SDG-4, SDG-8, SDG-9**

### **MINOR PROJECT**

Each student is given an exercise which will cover all the aspects ( to the extent possible) like investigation, planning, designing, detailing and estimating of a Computer Science and engineering structure in which the aspects like analysis, application of relevant codes, etc., will find a place. Alternatively, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as project work. Alternatively, a student is encouraged to take an industrial project with any Computer Science and engineering organization or firm. A project report is to be submitted on the topic which will be evaluated.

## SEMESTER – VIII

MAJOR PROJECT	
Course Code: 25CS4114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 24	
Credits: 12	

### COURSE OBJECTIVE

The objective of the project semester is to make the students solve real world problems using automated solutions, while developing management and writing skills amongst them.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Identify, formulate and analyse existing problems in the (non-automated) work flow for performing a specific task.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.
5. Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

### MAPPING BETWEEN COURSE OBJECTIVE (CO) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√	√	√	√	√

### MAPPED SDGs: SDG-4,SDG-8,SDG-9

### MAJOR PROJECT

Each student is given an exercise which will cover all the aspects ( to the extent possible) like investigation, planning, designing, detailing and estimating of a Computer Science and engineering structure in which the aspects like analysis, application of relevant codes, etc., will find a place. Alternatively, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as project work. Alternatively, a student is encouraged to take an industrial project with any Computer Science and engineering organization or firm. A project report is to be submitted on the topic which will be evaluated.

## SYLLABUS OF PROFESSIONAL ELECTIVE COURSES

<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	
Course Code: 25CSPE2007	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To impart knowledge of computer architecture and system organization.</li> <li>2. To explain instruction sets, addressing modes, and instruction cycles.</li> <li>3. To develop understanding of ALU design and arithmetic operations.</li> <li>4. To introduce control unit design: hardwired and microprogrammed.</li> <li>5. To examine memory systems and I/O interfacing with performance metrics.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify the components and architecture of a computer system.</li> <li>2. Differentiate and evaluate RISC and CISC architectures.</li> <li>3. Perform binary arithmetic operations using algorithms.</li> <li>4. Analyze control unit design using hardwired and microprogramming.</li> <li>5. Evaluate memory systems and caching techniques.</li> <li>6. CLO6: Explain and analyze I/O subsystems and interfacing mechanisms.</li> </ol>

### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
C01	√					
C02		√	√			
C03				√		
C04					√	
C05						√

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

**COURSE CONTENTS**

UNIT NUMBER	COURSE CONTENTS
<b>UNIT-I</b>	<b>INTRODUCTION</b> Evolution and types of computer systems, Functional units, Bus structures- location and addresses, memory operations, Addressing modes, Design of a computer system- Memory Instruction and instruction format and sequencing, RISC versus CISC.
<b>UNIT-II</b>	<b>CENTRAL PROCESSING UNIT</b> Introduction-Arithmetic Logic Unit - Fixed point arithmetic, floating point arithmetic- Execution of complete instruction Cycle-Basic concepts of pipelining and hazards, register organization, status flags.
<b>UNIT-III</b>	<b>CONTROL UNIT DESIGN</b> Introduction-Instruction cycle, Control Transfer, Fetch cycle Hardwired control, Micro-programmed control, horizontal vs vertical microinstructions.
<b>UNIT-IV</b>	<b>MEMORIES AND SUBSYSTEMS</b> Semiconductor memory - Static and Dynamic RAM, ROM types, Associative memory, Cache memory, Mapping techniques and replacement policies, Virtual Memory, Secondary memories: Optical magnetic tape & magnetic disks & controllers.
<b>UNIT-V</b>	<b>I/O PROCESSING</b> Introduction-Data transfer techniques- Bus Interface- I/O Channel-I/O Processor, I/O devices -Direct memory access, interrupt handling, performance metrics, and buffering strategies.

**TEXT BOOKS**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization and Embedded Systems*, 6th Edition, McGraw Hill, 2021.
2. David A. Patterson and John L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, 6th Edition, Morgan Kaufmann, 2021.
3. William Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson, 2023.

**REFERENCE BOOKS**

1. Morris Mano, *Computer System Architecture*, 4th Edition, Pearson, Reprint 2022.
2. John L. Hennessy and David A. Patterson, *Computer Architecture: A Quantitative Approach*, 6th Edition, Morgan Kaufmann, 2020.
3. Tanenbaum and Austin, *Structured Computer Organization*, 6th Edition, Pearson, 2021.

**Open Educational Resources (OERs)**

1. MIT OpenCourseWare – Computer System Architecture, <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-004-computati-on-structures-spring-2017/>
2. IIT Bombay FOSSEE – Digital Systems & Computer Organization <https://nptel.ac.in/courses/106101098>

**Open-Access Journals and Research Repositories**

1. **International Journal of Computer Architecture and Mobility (IJCAM)**  
<https://www.csejournal.com/>
2. **arXiv.org - Computer Architecture (cs.AR)**  
<https://arxiv.org/list/cs.AR/recent>
3. **Journal of Computer Architecture and High Performance Computing**  
<https://ijcaonline.org>.

**ANALYSIS AND DESIGN OF ALGORITHMS**

Course Code: 25CSPE2008	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
LT P : 3 0 0	
Credits: 3	

**COURSE OBJECTIVES**

1. To analyze the asymptotic performance and correctness of algorithms.
2. To explore key algorithm design strategies: divide and conquer, dynamic programming, and greedy methods.
3. To understand and implement graph algorithms and optimization techniques.
4. To solve computational problems using state space search, backtracking, and branch-and-bound.
5. To classify computational problems as tractable/intractable and explore NP-completeness and approximation algorithms.

**COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Analyze and compare the efficiency and correctness of algorithms using asymptotic notations.
2. Apply divide and conquer strategy and recurrence relation techniques to design and analyse algorithms.
3. Solve real-world problems using dynamic programming and greedy methods effectively.
4. Implement graph-based algorithms for traversal, path finding, and network flow problems.
5. Design solutions for complex optimization problems using backtracking, branch and bound, and approximation methods.

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

CLO's CO's	CLO1	CLO2	CLO3	CLO4	CLO5
C01	✓				
C02		✓			
C03			✓		
C04				✓	
C05					✓

Mapped SDGs: SDG-4, SDG-9, SDG-12

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<p><b>INTRODUCTION</b> <b>Algorithm analysis:</b> Time and space complexity - Asymptotic Notations and its properties- Best case, Worst case and average case analysis – Recurrence relation Solving Method: Substitution Method, Recurrence Tree Method, Master’s Method; Complexity Analysis of Searching &amp; Sorting Algorithms. <b>Pattern Matching:</b> The naïve string-matching algorithm, Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm.</p>
UNIT-II	<p><b>GRAPH ALGORITHMS</b> <b>Graph algorithms:</b> Graph Fundamentals , shortest path: Bellman-Ford algorithm, Dijkstra’s algorithm, Floyd-Warshall algorithm <b>Network flow:</b> Flow networks, Ford-Fulkerson method – Matching: Maximum bipartite matching.</p>
UNIT-III	<p><b>ALGORITHM DESIGN TECHNIQUES</b> <b>Divide and Conquer methodology:</b> Finding maximum and minimum - Merge sort - Quick sort , Applications <b>Dynamic programming:</b> Elements of dynamic programming, Matrix-chain multiplication, Multi stage graph, Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem – Optimal Merge pattern — Huffman coding.</p>
UNIT-IV	<p><b>STATE SPACE SEARCH ALGORITHMS</b> <b>Backtracking:</b> n-Queens problem, Hamiltonian Circuit Problem, Subset Sum Problem, Graph colouring problem, Branch and Bound: Solving 15-Puzzle problem, Assignment problem, Knapsack Problem, Travelling Salesman Problem.</p>
UNIT-V	<p><b>NP-COMPLETE AND APPROXIMATION ALGORITHM</b> <b>Tractable and intractable problems:</b> Polynomial time algorithms - NP-hardness and NP-completeness– Bin Packing problem - Problem reduction: TSP – 3-CNF problem. <b>Approximation Algorithms:</b> TSP - <b>Randomized Algorithms:</b> concept and application - primality testing - randomized quicksort - Finding kth smallest number.</p>

**TEXT BOOKS**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein *Introduction to Algorithms*, 4th Edition, MIT Press, 2022.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd Edition (Revised), Universities Press, 2021.
3. Richard Johnsonbaugh, Marcus Schaefer *Algorithms*, 4th Edition, Pearson Education, 2020

**REFERENCE BOOKS**

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, Pearson, Reprint Edition, 2022.
2. Anany Levitin *Introduction to the Design and Analysis of Algorithms*, 4th Edition, Pearson, 2019.
3. Sara Baas, Allen Van Gelder *Computer Algorithms: Introduction to Design and Analysis*, 3rd Edition, Pearson, 2021.
4. S. Sridhar *Design and Analysis of Algorithms*, Oxford University Press, 2021.

**Open Educational Resources (OERs)**

1. MIT OpenCourseWare – Design and Analysis of Algorithms, <https://ocw.mit.edu/search/?q=and+Analysis+of+Algorithms>
2. Khan Academy – Algorithms, <https://www.khanacademy.org/computing/computer-science/algorithms>
3. Coursera (Audit Free) – Algorithmic Toolbox by UC San Diego, <https://www.coursera.org/specializations/algorithms?>
4. VisuAlgo, <https://visualgo.net/en>

**Open Access Journals and Repositories**

1. Journal of Computer Science (Science Publications) <https://thescipub.com/journal/jcs>
2. International Journal of Computer Applications (IJCA) <https://www.ijcaonline.org>
3. International Journal of Computer Science and Information Security (IJCSIS) <https://sites.google.com/site/ijcsis/>
4. arXiv.org – Computer Science > Data Structures and Algorithms <https://arxiv.org/list/cs.DS/recent>  
Research preprints on latest algorithm techniques.
5. DOAJ (Directory of Open Access Journals) <https://www.doaj.org>

Course Code: 25CS2118	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To understand and apply the algorithm analysis techniques on searching and sorting algorithms.</li> <li>2. To critically analyze the efficiency of graph algorithms.</li> <li>3. To understand different algorithm design techniques.</li> <li>4. To solve programming problems using a state space tree.</li> <li>5. To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO's)</b>
<p>The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:</p> <ol style="list-style-type: none"> <li>1. Analyze the efficiency of algorithms using various frameworks.</li> <li>2. Apply graph algorithms to solve problems and analyze their efficiency.</li> <li>3. Implement various techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.</li> <li>4. Analyze &amp; Use the state space tree method for solving problems.</li> <li>5. Apply problems solving using approximation algorithms and randomized algorithms.</li> </ol>

**COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO) MAPPING**

CO \ CLO	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4, SDG-8,SDG-9, SDG-12**

<b>LIST OF EXPERIMENT:</b>
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<b>EXP-1</b>	Implement Linear and Binary Search to search a contact in an unsorted vs. alphabetically sorted phone book.
<b>EXP-2</b>	Implement Quick Sort using Divide and Conquer to prioritize emergency-room patients based on urgency (pivot-based triage).
<b>EXP-3</b>	Implement Merge Sort using Divide and Conquer to merge two sorted online shopping order queues efficiently.
<b>EXP-4</b>	Find Minimum and Maximum using Divide and Conquer to identify highest and lowest temperatures from sensor data.
<b>EXP-5</b>	Implement Fractional Knapsack using Greedy Method to optimally load a drone with medical supplies based on value-to-weight ratio.
<b>EXP-6</b>	Implement Prim's Algorithm using Greedy Method to connect computers in a lab using minimum total wire length.
<b>EXP-7</b>	Implement Kruskal's Algorithm using Greedy Method to plan road construction between towns minimizing total cost.
<b>EXP-8</b>	Implement Warshall's Algorithm to compute Transitive Closure and determine multi-step reachability in a social network.
<b>EXP-9</b>	Implement Dijkstra's Algorithm for Shortest Path to compute fastest routes from a driver to all customer locations in a ride-hailing app.
<b>EXP-10</b>	Solve the 8-Queens Problem using Backtracking to schedule 8 non-conflicting events in different time slots and halls.
<b>EXP-11</b>	Implement All-Pairs Shortest Path using Dynamic Programming (Floyd- Warshall) to find minimum delivery costs between all warehouse pairs.
<b>EXP-12</b>	Implement 0/1 Knapsack using Dynamic Programming to choose the most beneficial set of projects under a fixed budget
<b>EXP-13</b>	Implement Travelling Salesman Problem to find the shortest path of two city.
<b>EXP-14</b>	Implement randomized algorithms for finding the kth smallest number.

#### **TEXT BOOK:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
3. Richard Johnsonbaugh, Marcus Schaefer, " Algorithms ", Pearson Education, 2006 3rd edition

#### **REFERENCE BOOKS**

1. Aho, Ullman & Hopcraft, "The Design and Analysis of Algorithms", Pearson Education, 2001
2. S.E.Goodman, S.T.Hedetniemi, "Introduction to the Design and Analysis of Algorithms", McGraw Hill , 2006
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.

#### **OPEN EDUCATIONAL RESOURCES**

1. [https://youtu.be/uJUBd\\_3C12w?list=PL\\_uaeekrhGzJz9-D3-J8kJqg8ZEODt4y](https://youtu.be/uJUBd_3C12w?list=PL_uaeekrhGzJz9-D3-J8kJqg8ZEODt4y)

Course Code: 25CSPE3003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### **COURSE OBJECTIVE**

1. Understand the fundamentals of computer networks, reference models, types of networks and topologies, and analyse the characteristics of physical layer signals and transmission media.
2. Understand and apply error detection/correction techniques, framing, flow control, and media access control methods in the data link layer.
3. Understand IP addressing (IPv4 & IPv6), packet structures, and routing protocols used in the network layer.
4. Understand and analyse routing mechanisms, interconnecting devices, and key transport/application layer protocols.
5. Demonstrate understanding of network security principles, encryption techniques, and secure communication protocols.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Describe and analyse the Internet's evolution, network standards, OSI & TCP/IP models, types of networks, topologies, signal properties, and transmission techniques.
2. Explain data link layer functions including framing, error handling, and protocols like ALOHA, CSMA, and channelization methods such as TDMA, FDMA, and CDMA.
3. Differentiate IPv4 and IPv6 addressing schemes, explain packet formats, and analyse routing concepts and protocols such as RIP, OSPF, and BGP.
4. Describe network devices, explain routing and forwarding, and understand the working of TCP/UDP, congestion control, and common application layer protocols (SMTP, FTP, DNS, etc.).
5. Explain symmetric/asymmetric encryption, PKI, hash functions, digital signatures, and secure communication using SSL/TLS.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

CLOs COs	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4, SDG-9,SDG-11, SDG-16,SDG-17**

### **COURSE CONTENTS**

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<p><b>INTRODUCTION:</b> A brief History; Internet Standards and Standards organization; OSI Reference Model; TCP/IP Model; Types of Networks : Local Area Networks, Metropolitan Area Networks, Wide Area Network; Topologies: Bus, Star, Ring, Hybrid, Tree, Complete, Irregular - Topology; Addressing.</p> <p><b>Physical Layer</b> – Analog and digital signal properties: Sinewave, phase, wavelength, Bit rate, Transmission Impairment, Performance measures: Bandwidth, Throughput, Latency, Jitter; Guided and unguided transmission media; Circuit Switching, Packet Switching.</p>
UNIT-II	<p><b>DATA LINK LAYERS</b> Data link Layer design issues: Framing, Error Detection &amp; Correction: Byte and Bit stuffing, Checksum, CRC, Hamming codes; Elementary Data link Protocols- Sliding window Protocols; Media access control – Random Access: Aloha, CSMA, CSMA/CD; Controlled Access: Token Passing, Polling, Reservation; Channelization: TDMA, FDMA, CDMA; Ethernet Standard;</p>
UNIT-III	<p><b>NETWORK LAYERS PROTOCOLS</b> IPV4 Addressing – classful and classless, Network Address Translation, IPV4 Packet format- IPV6 Addressing, IPV6 Packet format.</p> <p><b>NETWORK ROUTING</b> Routing Concepts: Routing and Forwarding, Intra- and inter-domain routing, Distance vector routing, DVR Instability problem and solutions, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.</p>
UNIT-IV	<p><b>TRANSPORT &amp; APPLICATION LAYER</b> <b>Transmission Control Protocol:</b> User Datagram Protocol; Congestion control mechanisms; <b>Application Layer:</b> Email – SMTP, POP, IMAP; FTP, NNTP, HTTP, DNS, World Wide Web (WWW), Firewall.</p>
UNIT-V	<p><b>PRESENTATION AND SESSION LAYER</b> Network Security Basics: Introduction to Cryptography, Symmetric and Asymmetric Encryption, Public Key Infrastructure (PKI), Hash Functions (SHA, MD5), Digital Signatures, SSL/TLS protocols for secure communication, Session and dialogue control. NetBIOS, RPC etc.</p>

TEXT BOOKS
<ol style="list-style-type: none"> <li>1. Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005</li> <li>2. Computer Networking: A Top-Down Approach, Global Edition 8th Edition June 17, 2021</li> <li>3. James F. Kurose, Keith W. Ross "COMPUTER NETWORKING-A Top-Down Approach" Pearson 8th Edition 31/05/2022</li> </ol>
REFERENCE BOOKS
<ol style="list-style-type: none"> <li>1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.</li> <li>2. Data Communications and Networking with TCP/IP Protocol Suite, 6th Edition By Behrouz A. Forouzan © 2022</li> <li>3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, Third Edition 2003/ 8th Edition (Global) 2020</li> <li>4. William Stallings, "Data and Computer Communication", Seventh Edition, Pearson Education, 2003.</li> </ol>

5. Data and Computer Communications (William Stallings Books on Computer and Data Communications) 10th Edition by William Stallings (Author) 2013/2014

**OPEN EDUCATIONAL RESOURCES(OERs)**

1. NPTEL-Computer Networks and Internet Protocol, IIT Kharagpur Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty <https://nptel.ac.in/courses/106105183>
2. NIELIT Academy (Kishor S. Chaudhari, Principal Technical Officer) <https://www.nielit.gov.in/content/certified-system-and-networking-specialist>
3. Cisco Networking Academy <https://www.netacad.com/networking>
4. <https://www.geeksforgeeks.org/computer-networks/computer-network-tutorials/>

<b>COMPUTER NETWORKS LAB</b>	
Course Code: 25CSPE3113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. Demonstrate the use of basic network commands and hardware functionalities through practical experiments with real or simulated networking devices.</li> <li>2. Analyze packet transmission, flow control, and routing protocol performance, including OSPF configurations in single and multi-area environments.</li> <li>3. Configure and secure routers and switches by setting passwords, enabling WEP, and managing Ethernet, serial, and wireless interfaces.</li> <li>4. Design and implement network addressing schemes and DHCP services to enable structured and dynamic IP allocation in various network scenarios.</li> <li>5. Develop and simulate core network services and protocols, including DNS resolution, TCP/UDP behavior, and congestion control mechanisms.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Use basic network commands and demonstrate the working of essential networking hardware components.</li> <li>2. Analyze packet transmission and evaluate routing protocols and flow control mechanisms using real or simulated network environments.</li> <li>3. Configure routers, switches, and wireless devices, including setting passwords, enabling WEP, and managing interfaces.</li> <li>4. Design subnet-based IP addressing schemes and configure DHCP services for dynamic IP allocation.</li> <li>5. Develop and simulate core network services such as DNS, and evaluate transport layer protocols and congestion control techniques</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

<b>CLOs</b>	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	√	√			
<b>C02</b>		√	√		
<b>C03</b>			√		
<b>C04</b>				√	
<b>C05</b>					√

**Mapped SDGs: SDG-4, SDG-9, SDG-11, SDG-12, SDG-16**

## LIST OF PROGRAMS

1. Demonstrate the use of basic network commands and conduct a demo session on various networking hardware and their functionalities.
2. Observe and analyze packet flow across the network and evaluate the performance of different routing protocols.
3. Configure a basic router setup including setting passwords and configuring interfaces.
4. Study and implement various flow control mechanisms in computer networks.
5. Design and implement an appropriate IP addressing scheme for a given network scenario.
6. Simulate transport layer protocols (e.g., TCP, UDP) and analyze congestion control techniques used in networking.
7. Develop a DNS client-server application to resolve a given hostname or IP address.
8. Implement and analyze Single-Area and Multi-Area OSPF, focusing on link costs and interface configurations.
9. Configure WEP (Wired Equivalent Privacy) security on a wireless router and test its connectivity.
10. Configure Ethernet and serial interfaces on network devices and verify successful communication.
11. Configure a Cisco router as a DHCP server to dynamically allocate IP addresses.

### Note:

**Tools: ns-2/ns-3, Omnet++, Wireshark/Cisco packet tracer. 5 or more exercises can be given by the Faculty.**

TEXT BOOKS
<ol style="list-style-type: none"><li>1. Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005</li><li>2. Computer Networking: A Top-Down Approach, Global Edition 8th Edition June 17, 2021, James F. Kurose, Keith W. Ross "COMPUTER NETWORKING-A Top-Down Approach" Pearson 8th Edition 31/05/2022</li></ol>
REFERENCE BOOKS
<ol style="list-style-type: none"><li>1. Computer Networks: A Systems Approach, 4th Ed. (2007), by Larry Peterson and Bruce Davie. Covers background networking material with which students should have familiarity.</li></ol>

<b>OPTIMIZATION TECHNIQUES</b>	
Course Code: 25CSPE3027	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To identify and develop operational research models from the verbal description of the real system.</li> <li>2. To understand the mathematical tools that are needed to solve optimization problems.</li> <li>3. To use mathematical models of sequencing and replacement problems.</li> <li>4. To impart knowledge in concepts and tools of Inventory control.</li> <li>5. To develop a report that describes the queue model and the solving technique, analyse the results and propose recommendations.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. Understand the usage of linear programming and Simulation for Solving Business Problems.</li> <li>2. Conduct and interpret the assignment and transportation problems.</li> <li>3. Identify the optimal sequence and best age of replacement.</li> <li>4. Explain the meaning of Inventory control, various forms and functional role of Inventory.</li> <li>5. Able to explain the applications of queue models in real life.</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

CO \ CLO	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓				
CO 2		✓			
CO 3			✓		
CO 4				✓	
CO 5					✓

**Mapped SDGs: SDG-4, SDG-9**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>LINEAR PROGRAMMING</b> Introduction: Operations research and decision making, Types of mathematical models and constructing the model, Formulation of linear programming problem, Graphical Method, Simplex method
<b>UNIT-II</b>	<b>ASSIGNMENT &amp; TRANSPORTATION MODELS</b> Assignment models, Transportation problem, North west corner method. Least cost method, Vogel's approximation method – Modi method, Unbalance and degeneracy in transportation model
<b>UNIT-III</b>	<b>SCHEDULING AND REPLACEMENT PROBLEMS</b> Sequencing Problem, Processing 'n' jobs through two machines and three machines, processing two jobs through 'm' machines. Replacement model, Replacement of items that deteriorate, gradually, fail suddenly, and group replacement policy analysis.
<b>UNIT-IV</b>	<b>INVENTORY CONTROL</b> Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with and without shortages.
<b>UNIT-V</b>	<b>PRINCIPLES OF QUEUEING THEORY</b> Introduction: Queues and their characteristics, Queueing Models with Markovian Input and Markovian Service, M/M/1 & M/M/C Queueing Models.

#### **TEXT BOOKS**

1. Sharma, S. D. 2015, Operations Research, Theory Methods & Applications, Kadar Nath Ram Nath, Delhi.
2. Taha, H. A. 2007, Operations Research, 8th edn, Pearson.
3. Winston, W. L. 2004, Operations Research: Applications and Algorithms, 4th edn, Thomson.

#### **REFERENCE BOOKS**

1. Rader, D. J. 2010, Deterministic Operations Research: Models and Methods in Linear Optimization, J. Wiley & Sons.
2. Williams, H. P. 2013, Model Building in Mathematical Programming, 5th edn, Wiley
3. Schrage, L. 1997, Optimization Modeling with LINDO, 5th edn, Thomson.

#### **OPEN EDUCATIONAL RESOURCES(OERs)**

1. NPTEL – Optimization in Engineering Design (Prof. Bandyopadhyay, IIT Roorkee)
2. MIT OCW – Introduction to Optimization
3. Free Book – Introduction to Optimization, 4th ed. by Chong & Zak (PDF)

## DISTRIBUTED DATABASE

Course Code: 25CSPE3035	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVE

1. To understand theoretical and practical aspects of distributed database systems.
2. To introduce the students to the needed techniques that are used to design and manage a distributed database, such as fragmentation, query processing, recovery and replication.
3. To optimize the data retrieval using various algorithms.
4. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs.
5. To focus on performance and flexibility issues related to systems design decisions.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand distributed database systems architecture and design.
2. Apply methods and techniques for distributed query processing and optimisation.
3. Understand the broad concepts of distributed transaction process.
4. Understand Transaction Management & Compare various approaches to concurrency control in Distributed database.
5. Study and identify various issues related to the development of distributed database systems.
6. Understand the design aspects of object-oriented database system and related development.

### MAPPING COURSE LEARNING OUTCOME (CLO) - COURSE OBJECTIVE (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
C01	√					
C02		√				
C03			√			
C04				√		
C05					√	√

Mapped SDGs: SDG-4, SDG-9

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
<b>UNIT-I</b>	<p><b>INTRODUCTION</b> Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas, Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DBMS Architecture.</p> <p>Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.</p>

UNIT NUMBER	COURSE CONTENTS
UNIT-II	<p><b>QUERY PROCESSING AND DECOMPOSITION</b>            Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data, Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms.</p>
UNIT-III	<p><b>TRANSACTION MANAGEMENT</b>            Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms &amp; algorithms, time - stamped &amp; optimistic concurrency control Algorithms, deadlock Management.            Database Security :Storage strategies: Indices, B-trees, Hashing. Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.</p>
UNIT-IV	<p><b>DISTRIBUTED DBMS RELIABILITY</b>            Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local &amp; distributed reliability protocols, site failures and network partitioning.            Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.</p>
UNIT-V	<p><b>DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS</b>            Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.            Object Oriented Data Model: Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS.</p>

#### TEXT BOOKS

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

#### REFERENCE BOOKS

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition
2. Silberschatz, A., Korth, H. F., and Sudarshan, S. Database System Concepts, McGraw-Hill, 7th Edition. 2019

#### OPEN EDUCATIONAL RESOURCES(OERs)

1. NPTEL – Distributed Systems (Prof. P.K. Biswas, IIT Kharagpur)
2. MIT OCW – Introduction to Database Systems (with DDB Concepts)
3. Free Book: "Distributed Database Systems" by Ozsu & Valduriez – PDF

<b>COMPUTER GRAPHICS</b>	
Course Code: 25CSPE3019	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To gain knowledge about graphics hardware devices and software used.</li> <li>2. To identify various graphical algorithms to construct graphical primitives.</li> <li>3. To understand and evaluate the two dimensional, three dimensional graphics and their transformations and viewing techniques.</li> <li>4. To be familiar with clipping techniques and to appreciate illumination and color models</li> <li>5. To develop graphical programs for a multidisciplinary environment.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
<ol style="list-style-type: none"> <li>1. Illustrate the fundamentals of computer graphics hardware and software concepts.</li> <li>2. Design two dimensional and three dimensional graphics and apply three dimensional transformations.</li> <li>3. Demonstrate and Apply clipping techniques to graphics.</li> <li>4. Apply algorithms on different graphical models</li> <li>5. Apply Illumination and color models and design animation sequences.</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	√				
<b>C02</b>		√	√	√	
<b>C03</b>		√			
<b>C04</b>			√	√	√
<b>C05</b>				√	

**Mapped SDGs: SDG-4,SDG-9,SDG-11,SDG-13**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<p><b>INTRODUCTION TO COMPUTER GRAPHICS</b></p> <p>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.</p>

UNIT NUMBER	COURSE CONTENTS
<b>UNIT-II</b>	<p><b>TWO/THREE DIMENSIONAL VIEWING</b>            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).</p>
<b>UNIT-III</b>	<p><b>CLIPPING &amp; TRANSFORMATION</b>            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.</p>
<b>UNIT-IV</b>	<p><b>VIEWING IN 3D</b>            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.</p>
<b>UNIT-V</b>	<p><b>REPRESENTING CURVES AND SURFACES</b>            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.</p>

#### TEXT BOOKS

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

#### 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, Addison Wesley.
2. Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition
3. Fundamentals of 3Dimensional Computer Graphics by Alan Watt, 1999, Addison Wesley.
4. Computer Graphics: Secrets and Solutions by Corrign John, BPB
5. Graphics, GUI, Games & Multimedia Projects in C by Pilania & Mahendra, Standard Publ.

#### OPEN EDUCATIONAL RESOURCES(OERs)

1. YouTube – DDA and Bresenham Algorithms Explained
2. Open Text – Fundamentals of Computer Graphics (Ch. 2)
3. WebGL Playground – Interactive Line Drawing
4. NPTEL – Computer Graphics by Prof. Sukhendu Das (IIT Madras)
5. MIT OpenCourseWare – Graphics and Visualization
6. Computer Graphics Basics – Free PDF by Peter Shirley (Ray Tracing Series)

<b>SYSTEM MODELING AND SIMULATION</b>	
Course Code: 25CSPE3021	Continuous Evaluation: 40 Marks
Pre-Requisite : Mathematics, Computer Networks, Java	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE (CO)</b>
<ol style="list-style-type: none"> <li>1. To understand various mathematical models, simulation techniques and its applications.</li> <li>2. To Review basic simulation methods and principles applied to the architecting and engineering of complex systems.</li> <li>3. To describe the art and science of the modeling process, especially as applied to complex systems, and provide access to tools and executable models. - Cover continuous, discrete-event and other simulation methods.</li> <li>4. To develop and execute their own simulation models. - Be exposed to a variety of simulation applications for system architecting and engineering disciplines by domain experts.</li> <li>5. To develop simulation term projects that address critical research issues and/or industrial applications in systems architecting and engineering.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Remember and understand the concepts of system and environment.</li> <li>2. Understand and apply the concepts of statistics in simulation.</li> <li>3. Apply and analyze how random numbers can be used for simulation and modelling.</li> <li>4. Evaluate the concepts of simulation and modelling on test data.</li> <li>5. Create and explore the applications of simulation.</li> </ol>

**MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	✓				
<b>CO2</b>		✓			
<b>CO3</b>			✓	✓	
<b>CO4</b>				✓	
<b>CO5</b>					✓

**Mapped SDGs: SDG-4,SDG-9**

**COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<p><b>INTRODUCTION</b>  Systems &amp; Environment – Discrete &amp; Continuous systems- model of a system – Types- Discrete event system simulation – steps; Simulation Example – Queuing systems – Inventory systems – other examples; General Principles – concepts in Discrete event simulation – List processing.</p>
<b>UNIT-II</b>	<p><b>STATISTICAL MODELS</b>                      Statistical models – Discrete &amp; Continuous distributions – Poisson process; Queuing models – Characteristics – notations; long</p>

	run measure of performance of queuing systems – server utilization – costs in queuing problems; steady-state behavior of infinite population Markovian models- Multiserver Queue. Parallel and distributed simulation, Real-time simulation, Simulation optimization Simulation of complex systems
<b>UNIT-III</b>	<b>RANDOM NUMBERS</b> Random number generation – Properties – Generation of Pseudo Random numbers – Techniques for generation– Tests for Random numbers – Random variate generation –Inverse Transform Technique – Exponential, Uniform, Weibull, Triangular, Empirical continuous, Discrete distributions- Acceptance Rejection principle.
<b>UNIT-IV</b>	<b>ANALYSIS OF SIMULATION DATA</b> Input modelling – Identifying the distribution – parameter estimations – Goodness of Fit test– Fitting a non-stationery poison process – selecting input models without data; Verification and Validation of simulation models- model building – verification of models – calibration and validation of models – output analysis for a single model.
<b>UNIT-V</b>	<b>SIMULATION AND SIMULATION APPLICATIONS</b> Simulation using SIMULINK, examples of simulation problems- simple and the compound pendulum, planner mechanisms, validation and verification of the simulation model, parameter estimation methods, system identifications, introduction to optimization. <b>Case Studies and Applications</b> Detailed case studies from various domains (e.g., manufacturing, healthcare, transportation etc.), Student presentations on simulation projects

#### TEXT BOOKS

- Jerry Banks, John S.Carson, Barry L.Nelson, David M. Nicol, “*Discrete Event System Simulation*”, Pearson Education, Fourth Edition, 2005
- Ptolemaeus, Claudius. System Design, Modeling, and Simulation: Using Ptolemy II. United Kingdom: Ptolemy.org, 2013.

#### REFERENCE BOOKS

- Geoffery Gordon, “*System Simulation*”, Pearson Education, 2<sup>nd</sup> Edition, 2007
- ArerillM.Law, David Kelton, “ *Simulation Modelling & Analysis*”, McGraw Hill International Edition, 2000.
- Kheir, Naim, ed. *Systems modeling and computer simulation*. Routledge, 2018.
- Severence, Frank L. *System modeling and simulation: an introduction*. John Wiley & Sons, 2009.

#### OPEN EDUCATIONAL RESOURCES(OERs)

1. Discrete Event Simulation Tutorial (CMU)
2. Arena Simulation Tutorials – YouTube (Industrial Engineering)
3. Arena Simulation Free Trial (Rockwell)
4. Random Number Generation – NPTEL
5. Lecture Notes – Monte Carlo Methods (MIT)
6. Python Notebook – Random Number Generation

<b>DIGITAL IMAGE PROCESSING</b>	
Course Code: 25CSPE3023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

### **COURSE OBJECTIVES(CO)**

1. To describe and explain basic principles of digital image processing.
2. To cover techniques and tools for digital image processing, image transformation in spatial and frequency domains.
3. To design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).
4. To design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
5. To assess the performance of image processing algorithms and systems in various applications. It introduces image analysis techniques in the form of image segmentation.
6. To enable students to have skills that will help them to solve complex real-world problems and to encourage them to develop the image processing tools from scratch, rather than using any image processing library functions

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Comprehend the need and usage of concepts of image processing.
2. Explore different image processing tools and study its various features.
3. Enhance the visual quality of given grey/color image using well known transformations and filters.
4. Learn different causes for image degradation and overview of image restoration techniques.
5. Segment the regions of a given image using various feature extraction algorithms in order to recognize objects.
6. Demonstrate the use of MATLAB to create interactive image processing applications.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>
<b>C01</b>	√					
<b>C02</b>		√				
<b>C03</b>			√	√		
<b>C04</b>				√		
<b>C05</b>					√	
<b>C06</b>					√	√

**Mapped SDGs: SDG-4, SDG-9**

## COURSE CONTENTS

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Introduction: Origin & Goals of DIP, Components of Image processing system, Key Stages in DIP; Human Vision System: Elements of visual perception, Image Formation in the Eye, Brightness Adaptation and Discrimination, Light and EM spectrum; Image sensing and acquisition: Image sampling and Quantization, Image Representation, Relationship b/w Pixels, Color Fundamentals, Arithmetic / Logic operations
<b>UNIT-II</b>	<b>IMAGE ENHANCEMENT</b> Spatial Domain: Gray level transformation, Histogram processing, Correlation and Convolution, Spatial filtering, Smoothing filters, Sharpening filters; Frequency Domain: 2D sampling, Fourier transform, Smoothing frequency domain filters, Sharpening filters, Homographic filtering.
<b>UNIT-III</b>	<b>IMAGE RESTORATION</b> Image Restoration: Model of Image degradation/ restoration process, Noise characterization, Noise models; Spatial Filters: Mean filters, Order statistics filter, Adaptive filters; Frequency Domain Filter: Band pass filter, Band reject filter, Notch filter, Optimum notch filters; Inverse filtering; Weiner filter; Geometric mean filters.
<b>UNIT-IV</b>	<b>IMAGE COMPRESSION AND MORPHOLOGICAL PROCESSING</b> Image compression: Coding redundancy, Spatial and temporal redundancy, Image compression models, Image formats; Basic compression method: Lossless and lossy compression, Huffman coding, arithmetic coding, LZW coding, Run length coding, Bit-plane coding. Morphological processing: Erosion and dilation, Opening and closing, Basic algorithms- boundary extraction, hole filling, convex hull, thinning, thickening.
<b>UNIT-V</b>	<b>IMAGE SEGMENTATION, REPRESENTATION &amp; DESCRIPTION</b> Segmentation: Points, Line and Edge detection, Thresholding, Region based segmentation; Representation & Description: Boundary following, Chain codes, Polygonal approximations, Signatures, Boundary segments, Skeletons, Boundary descriptors, Regional descriptors.
<b>UNIT-VI</b>	<b>PROJECT</b> Research Activities and hands-on experience to solve complex real-world problems using any image processing library function. <b>Tools:</b> MATLAB or Octave Python with libraries such as OpenCV, scikit-image, and NumPy

**TEXT BOOKS**

- Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing" , 4<sup>th</sup> edition , Pearson Education, 2018.
- Annadurai, R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", 1<sup>st</sup> edition, Pearson Education, 2007.

**REFERENCE BOOKS**

1. Rafael C. Gonzalez, Richard E. Woods, Eddins, "Digital Image Processing using MATLAB", 4<sup>th</sup> edition, Pearson Education, 2020
2. Anil Jain K. "Fundamentals of Digital Image Processing", 1<sup>st</sup> edition, PHI,1999
3. William Pratt , "Digital Image Processing", Wiley Inderscience, 4th edition 2006

**OPEN EDUCATIONAL RESOURCES**

1. **Digital Image Processing Using MATLAB - Gonzalez & Woods:**  
<http://www.imageprocessingplace.com>
2. **Digital Image Processing by Prof. P.K. Biswas (IIT Kharagpur, NPTEL):**  
<https://nptel.ac.in/courses/117105135>
3. **Image Processing - MIT OpenCourseWare:**  
<https://ocw.mit.edu/courses/health-sciences-and-technology/hst-582j-biomedical-signal-and-image-processing-spring-2007/>
4. **Image and Video Processing: From Mars to Hollywood - Duke University:**  
<https://www.coursera.org/learn/image-processing>

<b>VISUAL PROGRAMMING</b>	
Course Code: 25CSPE3025	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To identify and use the features of a Visual Basic (VB) development environment.</li> <li>2. To use the properties and methods of forms and controls to design VB applications.</li> <li>3. To write procedures to perform input, processing, and output.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. Understands the visual programming concepts and can explain basic concepts and definitions.</li> <li>2. Create programs that use decisions and repetition and Write statements that use various mathematical operators.</li> <li>3. Design the front end or Graphical User Interface for any application.</li> <li>4. Link the front end with the back-end and create an interactive environment.</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
<b>CO1</b>	√	√		
<b>CO2</b>			√	
<b>CO3</b>				√

**Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-11**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	Introduction to VB: Visual & non-visual programming, Procedural, Object-oriented and event driven programming languages, The VB environment: Menu bar, Toolbar, Project explorer, Toolbox, Properties window, Form designer, Form layout, Immediate window. Visual Development and Event Driven programming.
<b>UNIT-II</b>	<b>Basics of Programming:</b> Variables: Declaring variables, Types of variables, Converting variables types, User-defined data types, Forcing variable declaration, Scope & lifetime of variables. Constants: Named & intrinsic. Operators: Arithmetic, Relational & Logical operators. I/O in VB: Various controls for I/O in VB, Message box, Input Box, Print statement.

UNIT NUMBER	COURSE CONTENTS
UNIT-III	<b>Programming with VB:</b> Decisions and conditions: If statement, If-then-else, Select-case. Looping statements: Do-loops, For-next, While-wend, Exit statement. Nested control structures. Arrays: Declaring and using arrays, one-dimensional and multi-dimensional arrays, Static & dynamic arrays, Arrays of array. Collections: Adding, Removing, Counting, Returning items in a collection, Processing a collection.
UNIT-IV	<b>Programming with VB:</b> Procedures: General & event procedures, Subroutines, Functions, Calling procedures, Arguments- passing mechanisms, Optional arguments, Named arguments, Functions returning custom data types, Functions returning arrays.
UNIT-V	<b>Working with forms and menus :</b> Adding multiple forms in VB, Hiding & showing forms, Load & unload statements, creating menu, submenu, popup menus, Activate & deactivate events, Form-load event, menu designing in VB Simple programs in VB.

#### TEXT BOOKS

1. Steven Holzner, "Visual Basic 6 Programming: Black Book", Dreamtech Press.
2. Evangelos Petroustos. "Mastering Visual Basic 6", BPB Publications.
3. Michael Halvorson, "Step by Step Microsoft Visual Basic 6.0 Professional", PHI Visual basic 6 Complete", BPB Publications.

#### REFERENCE BOOKS

1. Scott Warner, "Teach Yourself Visual basic 6", Tata McGraw-Hill Edition
2. Brian Siler and Jeff Spotts, "Using Visual Basic 6", Special Edition, PHI.
3. Julia Case Bradley & Anita C. Millsbaugh, "Programming in Visual Basic 6.0"

#### OPEN EDUCATIONAL RESOURCES(OERs)

1. NPTEL: Visual Programming – IIT Madras
2. MIT App Inventor – Docs and Tutorials
3. Scratch Programming – Curriculum Guide
4. Scratch Online Editor
5. Blockly Games – Google

## PRINCIPLES OF PROGRAMMING LANGUAGES

Course Code: 25CSPE3033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
LT P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVES

1. To introduce the semantics of programming languages.
2. To develop skills in describing, analysing, and using the features of programming languages.
3. To learn the principles and techniques involved in design and implementation of modern programming languages.
4. To introduce frameworks for specifying and reasoning about programming languages.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Gain knowledge of the basic entities of computer programming languages.
2. Gain knowledge of different categories of programming languages.
3. Apply the knowledge for identifying the appropriate programming language for a particular development scenario.
4. Logically analyze the advantages and disadvantages of using different programming language for different computer problem

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4
C01	√			
C02		√		
C03			√	
C04				√

Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-17

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>PRELIMINARY CONCEPTS</b> High Level Languages, Issues in Programming - Case studies, Programming paradigms, Language implementation. Syntactic Structure — Language representation, Abstract Syntax tree, Lexical syntax, Context Free Grammars, Variants of CFG, Issues involved and Normal Forms for CFG

<b>UNIT-II</b>	<b>Lambda Calculus and Turing Machines:</b> Equivalence of Lambda calculus and Turing machines, free and bound variables, substitutions. <b>Type Theory:</b> Operational semantics, basic type systems and type soundness, advanced type systems.
<b>UNIT-III</b>	<b>Language Design and Implementation</b> Principles of language design, Domain-specific languages (DSLs), Scripting languages vs. system languages , Case studies of language design (Python, Rust, Swift)
<b>UNIT-IV</b>	<b>FUNCTIONAL &amp; CONCURRENT PROGRAMMING</b> Functional Programming — Features, Implementation, Types — values and operations, Product of types. Lists and Operations on Lists, Functions from a domain to a range, Function Application, Lexical Scope. Bindings of values and functions (Using Haskell/ Lisp as example language) <b>Concurrent Programming:</b> Threads, processes, synchronization monitors, concurrent objects, concurrent programming in Java/MPI/CILK
<b>UNIT-V</b>	<b>LOGIC PROGRAMMING</b> Formal Logic Systems, Working with relations and their implementation (Using Prolog as example). Database query Languages, Exception handling (Using SQL as example) Program Verification: Hoare logic, model checking, model checkers, algorithmic versus deductive approaches

#### TEXT BOOKS

1. Sethi, R., “Programming Languages: Concepts and Constructs”, Pearson Education.2004
2. Tucker, A. and Noonan, R., “Programming Languages: Principles and Paradigms”, Tata McGraw-Hill.2007.
3. Van Roy, P. and Haridi, S., “Concepts, Techniques and Models of Computer Programming”, Prentice-Hall of India.

#### REFERENCE BOOKS

1. Programming Language Pragmatics. Michael Scott, Morgan Kaufmann, 2000.
2. Essentials of Programming Languages. Friedman, Wand and Haynes, Prentice-Hall International (PHI), 1998.
3. Principles of Programming Languages. Tennant. PHI, 1981.
4. Benjamin Pierce, Types and Programming Languages, MIT Press, 2002.
5. David Watt, Programming Language Design Concepts, Willey, 2004.
6. Kenneth Loudon, Programming Languages: Principles & Practice,Thomson, 2003
7. “Concepts of Programming Languages” by Robert W. Sebesta (12th Edition, 2019, Pearson)

#### OPEN EDUCATIONAL RESOURCES(OERs)

1. W3Schools – Language Comparison
2. YouTube – Stanford CS107 Lectures (C Language Types & Structures)
3. Python Tutor – Visualize Execution

<b>THEORY OF APP DEVELOPMENT</b>	
Course Code: 25CSPE3037	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of Android platform, components, and development environment.</li> <li>2. Design and develop user interfaces using Android XML layouts and interactive elements.</li> <li>3. Apply Android components such as storage, multimedia, sensors, and location services to build responsive applications.</li> <li>4. Test, debug, and deploy Android applications with attention to resource management and compatibility.</li> <li>5. Undertake a complete Android development project, demonstrating end-to-end mobile application development skills.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Describe Android architecture, application components, and build simple applications using Java and Android Studio.</li> <li>2. Design UI layouts using XML and implement dynamic interaction using views, menus, and user inputs.</li> <li>3. Develop applications integrating persistent storage, multimedia APIs, location, and sensors.</li> <li>4. Perform testing, debugging, and prepare the app for deployment on the Google Play Store.</li> <li>5. Conceive, design, and implement a complete Android application project addressing a practical need.</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>	√	√			
<b>CO3</b>			√	√	
<b>CO4</b>			√	√	√

**Mapped SDGs: SDG-4,SDG-8,SDG-9,SDG-11,SDG-17**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>

<p><b>UNIT-I</b></p>	<p><b>Introduction to Android and App Development Basics</b>  Overview of Mobile App Development Ecosystem; Introduction to Android OS and its Architecture; Setting up the Android Development Environment; Kotlin vs Java: Choosing the language; Fundamentals of Java/Kotlin for App Development; Creating your first Android App (Hello World); Understanding Activities, Intents, and Fragments; Basic Android Manifest Configuration.</p> <p><b>Tutorial Exercises:</b></p> <ul style="list-style-type: none"> <li>● Set up Android Studio and Emulator</li> <li>● Create HelloWorld Android app using Activities and Intents</li> <li>● Practice navigation using Fragments</li> <li>● Modify AndroidManifest.xml for basic permissions</li> </ul>
<p><b>UNIT-II</b></p>	<p><b>User Interface and App Interaction Design</b>  Creating Layouts with XML (Linear, Constraint, Frame); Working with Views, Buttons, Text Input, and Spinners; Handling User Input and Events; Material Design Principles and Responsive Layouts; Introduction to RecyclerView and Adapter Patterns; Using Themes, Styles, and Resource Management; Working with Menus and Dialogs</p> <p><b>Tutorial Exercises:</b></p> <ul style="list-style-type: none"> <li>● Design a user interface with multiple layouts</li> <li>● Implement a form that collects user input</li> <li>● Practice RecyclerView with data lists</li> <li>● Style an app using custom themes and colors</li> </ul>
<p><b>UNIT-III</b></p>	<p><b>Data Storage, APIs, and App Functionality</b>  Understanding Android App Lifecycle; Persistent Storage with SharedPreferences; File and Internal Storage; SQLite Database: Creating, Reading, Updating, Deleting (CRUD); Working with JSON and consuming REST APIs using Retrofit/Volley; Working with Networking APIs and Permissions; Basic Error Handling and Logging</p> <p><b>Tutorial Exercises:</b></p> <ul style="list-style-type: none"> <li>● Store user preferences (dark mode toggle)</li> <li>● Create and manage a SQLite database</li> <li>● Fetch data from a public API and display using RecyclerView</li> <li>● Practice HTTP requests and error handling</li> </ul>
<p><b>UNIT-IV</b></p>	<p><b>Testing, Deployment &amp; Monetization</b>  Debugging and Logging Techniques in Android; Unit Testing and Instrumentation Testing Basics; Building APKs and Signing the App; Publishing to Google Play Store; Understanding Permissions and Privacy Guidelines; Intro to App Monetization (Ads, In-App Purchases – conceptual only); Supporting Multiple Devices and Screen Sizes</p> <p><b>Tutorial Exercises:</b></p> <ul style="list-style-type: none"> <li>● Simulate unit tests using Android testing frameworks</li> <li>● Create signed APK and deploy locally</li> <li>● Explore Google Play Store deployment steps</li> <li>● Explore AdMob documentation (no implementation)</li> </ul>

<b>UNIT-V</b>	<p><b>Project Work and Report Writing</b></p> <ul style="list-style-type: none"> <li>● Hands-on guided project: Plan, design, and build a simple Android app</li> <li>● Students should be encouraged to pick one of the following: <ul style="list-style-type: none"> <li>○ Health Tracker / Productivity Tool / To-do Manager / Notes App / Weather App</li> </ul> </li> <li>● Preparation of project documentation and project report using <b>LaTeX</b></li> <li>● Final presentation and optional deployment to Google Play (sandbox)</li> </ul> <p><b>Suggested steps:</b> Weekly milestone reviews; Integrate UI + data + API; Prepare project reports using LaTeX templates; Create a GitHub repository and maintain commits</p>
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<b>TEXT BOOKS</b>
<ol style="list-style-type: none"> <li>1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 3rd ed. (2013).</li> <li>2. Pradeep Kothari, "Android Application Development: Black Book", Dreamtech Press, Kindle Edition 2014.</li> </ol>
<b>REFERENCE BOOKS</b>
<ol style="list-style-type: none"> <li>1. Bill Phillips and Brian Hardy, "Android Programming: The Big Nerd Ranch Guide", Big Nerd Ranch Guides, Addison-Wesley Professional, 2013</li> <li>2. Jesse Feiler, "IOS App Development for Dummies", Wiley, 1st Edition.</li> </ol>
<b>OPEN EDUCATIONAL RESOURCES</b>
<ol style="list-style-type: none"> <li>1. <a href="https://www.geeksforgeeks.org/android/java-for-android-building-your-first-android-app/">https://www.geeksforgeeks.org/android/java-for-android-building-your-first-android-app/</a></li> <li>2. <a href="https://youtu.be/fis26HvvDII">https://youtu.be/fis26HvvDII</a> (freeCodeCamp.org)</li> <li>3. <a href="http://doi.org/10.11591/ijaas.v7.i4.pp317-321">http://doi.org/10.11591/ijaas.v7.i4.pp317-321</a></li> </ol>

## BLOCK CHAIN

Course Code: 25CSPE3039	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVE

1. Understand and analyze the core concepts of blockchain technology, including consensus mechanisms and distributed systems.
2. Apply cryptographic techniques used in blockchain systems to ensure security and integrity.
3. Evaluate the design and functionality of Bitcoin and other UTXO-based blockchain systems.
4. Design, develop, and test smart contracts on Ethereum and other blockchain platforms.
5. Analyze emerging trends in blockchain including zero-knowledge proofs, interoperability, and industrial applications.

### COURSE LEARNING OUTCOMES (CLO)

1. Illustrate and compare different consensus protocols such as PoW, PoS, and hybrid models using formal models.
2. Apply hash functions, digital signatures, and elliptic curve cryptography in blockchain implementations.
3. Demonstrate the ability to work with Bitcoin transactions, wallets, and address structures while evaluating their security implications.
4. Develop and deploy basic smart contracts using Solidity on Ethereum, and explain the EVM architecture and vulnerabilities.
5. Identify and explore advanced blockchain concepts such as zk-SNARKs, Layer-2 solutions, and use cases in finance and supply chain.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4, SDG-9, SDG-16**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Cryptography for Blockchain:</b> Cryptographic Foundations for Blockchain, Hash Functions (SHA-2, Keccak/SHA-3), Digital Signature Schemes (ECDSA, EdDSA), Public Key Encryption and Key Exchange, Elliptic Curve Cryptography (ECC) Basics, Merkle Trees and Applications in Blockchain, Commitment Schemes, Zero Knowledge Basics, Security Assumptions and Threat Models.
UNIT-II	<b>Consensus Mechanisms and Blockchain Models</b> Introduction to the Consensus Problem: Asynchronous Byzantine Agreement, ACP Protocol and Analysis, Nakamoto Consensus in Permission-less Peer-to-Peer Networks, Abstract Blockchain Models: GARA Model, RLA Model, Proof of Work (PoW) as Random Oracle: Formal Analysis, Formal Properties: Consistency, Liveness, Fairness, Proof of Stake (PoS) and Variants, Hybrid Consensus Models: PoW + PoS Introduction to Alternative Mechanisms: DPoS, PBFT, DAGs (e.g., Hashgraph, IOTA)
UNIT-III	<b>Bitcoin and UTXO-Based Blockchains</b> Bitcoin Overview: Design Philosophy and Architecture, Wallets, Addresses, and Key Management, Transactions: Structure, Verification, and Script Language, Blockchain Structure: Blocks, Headers, and Merkle Trees, Mining and Proof-of-Work: Difficulty Adjustment, Security Issues: Forks, Double Spending, 51% Attacks, Anonymity and Pseudonymity in Bitcoin, Mathematical Modeling of Bitcoin's Properties, Limitations and Scalability Challenges
UNIT-IV	<b>Ethereum, Smart Contracts, and Enterprise Blockchain</b> Ethereum Overview: Accounts Model vs. Bitcoin's UTXO, Ethereum Virtual Machine (EVM) Architecture, Writing Smart Contracts using Solidity, Smart Contract Lifecycle: Deployment and Interaction, Security Risks and Common Attacks (e.g., Reentrancy, Integer Overflow) <b>Tools:</b> Remix IDE, Truffle, Ganache, MetaMask, Introduction to Hyperledger Fabric and Modular Blockchain Platforms, Layer-2 Solutions: Rollups, Plasma, State Channels.
UNIT-V	<b>TRENDS AND TOPICS</b> Zero Knowledge proofs and protocols in Blockchain, Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash, Blockchain Use Cases: Finance and Industry. <b>Advanced Topics and Blockchain Use Cases</b> Zero-Knowledge Proofs (ZKPs) in Blockchain: zk-SNARKs, zk-STARKs, Pairing-based Cryptography, Privacy-focused Blockchains: Zcash, Monero, Token Standards: ERC-20, ERC-721, ERC-1155, Cross-Chain Communication and Interoperability <b>Blockchain Use Cases :</b> Finance (DeFi, CBDCs), Supply Chain and Logistics, Healthcare and Identity Management, Voting and Governance, Emerging Trends: Decentralized Identity (DID), DAOs, NFT Ecosystems

## TEXT BOOKS

1. Mastering Bitcoin – Andreas M. Antonopoulos, O'Reilly Media.
2. Mastering Ethereum – Andreas M. Antonopoulos & Gavin Wood, O'Reilly Media.
3. Bitcoin and Cryptocurrency Technologies – Arvind Narayanan et al., Princeton University Press

## REFERENCE BOOKS

1. **Ethereum Official Documentation** – <https://ethereum.org>
2. **Solidity Language Documentation** – <https://soliditylang.org>
3. **ZK-SNARKs Explained** – Vitalik Buterin's Blog and Zcash Documentation
4. **Hyperledger Fabric Documentation** – <https://hyperledger-fabric.readthedocs.io>
5. **Layer-2 Protocols Overview** – <https://l2beat.com>

## OPEN EDUCATIONAL RESOURCES

1. <https://eprint.iacr.org/2014/349.pdf>
2. <https://eprint.iacr.org/2012/718.pdf>
3. <https://github.com/ElementsProject/lightning/blob/master/doc/deployable-lightning.pdf>
4. <https://www.hyperledger.org/use/tutorials>
5. <https://docs.soliditylang.org/en/latest>
6. <https://github.com/ethereum/wiki/wiki/White-Paper>
7. <http://gavwood.com/paper.pdf>
8. <https://eprint.iacr.org/2018/601.pdf>
9. <https://eprint.iacr.org/2018/712.pdf>

<b>DATA SCIENCE</b>	
Course Code: 25CSPE3041	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

<b>COURSE OBJECTIVE (CO)</b>
<ol style="list-style-type: none"> <li>1. Introducing R as a programming language.</li> <li>2. Introduce the mathematical foundations required for data science.</li> <li>3. Introduce the first level data science algorithms.</li> <li>4. Introduce a data analytics problem solving framework.</li> <li>5. Apply basic data science techniques for regression, classification, and clustering problems.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. Describe a flow process for data science problems (Remembering).</li> <li>2. Classify data science problems into standard typology (Comprehension)</li> <li>3. Develop R codes for data science solutions (Application)</li> <li>4. Correlate results to the solution approach followed (Analysis) Assess the solution approach (Evaluation)</li> <li>5. Construct use cases to validate approach and identify modifications required (Creating).</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>		√			
<b>CO3</b>			√		
<b>CO4</b>				√	
<b>CO5</b>					√

**Mapped SDGs: SDG-4,SDG- 8, SDG-9, SDG-10, SDG-17**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENT</b>
<b>UNIT-I</b>	<b>UNIT 1: Introduction &amp; Mathematical Foundations</b>

	Course philosophy, tools overview, introduction to R programming, Linear Algebra for Data Science, Algebraic view: vectors, matrices, matrix-vector products, rank, null space Overdetermined System, pseudo-inverse. Geometric view: distances, projections, eigenvalues and eigenvectors
<b>UNIT-II</b>	<b>UNIT 2: Statistical Foundations</b> Descriptive statistics: mean, median, variance Probability concepts and distributions Covariance, covariance matrix, Understanding univariate & multivariate normal distributions Hypothesis testing
<b>UNIT-III</b>	<b>UNIT 3: Optimization &amp; Problem Typologies</b> Objective functions, constraints, basics of optimization, Gradient descent (conceptual understanding), Types of data science problems, problem formulation, modeling, and evaluation framework.
<b>UNIT-IV</b>	<b>UNIT 4: Regression Modeling</b> Simple linear regression and assumption checking Multivariate regression: modeling, diagnostics Model evaluation metrics Variable importance, feature selection techniques.
<b>UNIT-V</b>	<b>UNIT 5: Classification &amp; Clustering</b> Logistic regression for classification k-Nearest Neighbors (kNN) classifier k-means clustering for unsupervised learning Comparison of methods and appropriate use-cases.

#### **TEXT BOOKS**

1. **The Art of R Programming** by Norman Matloff, No Starch Press, 2011. *Comprehensive guide to R programming, covering basics to advanced topics.*
2. **An Introduction to Statistical Learning** by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, Springer, 2013. *Excellent resource on statistics, regression, classification, and machine learning with R labs.*

#### **REFERENCE BOOKS**

1. **Data Mining: Concepts and Techniques** by Jiawei Han, Micheline Kamber, and Jian Pei, Morgan Kaufmann, 2011. *Authoritative book on data mining algorithms including clustering and classification.*
2. **Practical Statistics for Data Scientists** by Peter Bruce, Andrew Bruce, and Peter Gedeck, O'Reilly Media, 2020.

#### **OPEN EDUCATIONAL RESOURCES**

1. <https://nptel.ac.in/courses/106106179>

## SOFT COMPUTING

Course Code: 25CSPE3031	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

### COURSE OBJECTIVES (CO)

1. To understand the role and requirement of Soft Computing.
2. To introduce ANN and various components associated with it.
3. To introduce and discuss fuzzy set theory and FRBS.
4. To understand the concepts of GA.
5. To provide an insight on how the two methods can be integrated and design hybrid systems.
6. To introduce various tools for visualization and design of Soft Computing Applications.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the need of soft computing and its components.
2. Design and understand simple applications using Single and Multi-layer perceptron.
3. Understand the concepts of Fuzzy controllers and their design principles.
4. Familiarize yourself with the single and multi-objective optimization methods through Genetic Algorithms.
5. Understand the design principles for hybrid systems.
6. Develop and design real time applications using Soft Computing Principles.

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
C01	√					
C02		√				
C03			√			
C04				√		
C05					√	
C06						√

**Mapped SDGs: SDG-4, SDG-9**

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
<b>UNIT-I</b>	<p><b>INTRODUCTION</b>  <b>SOFT COMPUTING:</b> Definition, hard and soft computing, major areas of Soft computing, Requirements and Applications of Soft computing.  <b>Introduction to ANN:</b> What is Neural Network, Learning rules and activation functions, Single layer Perceptrons, Back Propagation Algorithm, Adaptive Resonance theory and Self Organizing Map.</p>
<b>UNIT-II</b>	<p><b>FUZZY SETS:</b> Fuzzy set theory, fuzzy set operations, fuzzy rule Base system</p>

UNIT NUMBER	COURSE CONTENT
	(FRBS), Fuzzification, Defuzzification.
<b>UNIT-III</b>	<b>GENETIC ALGORITHMS</b> : Introduction, Working principle, Generation of population, GA Operators : Encoding, Fitness Function, Reproduction, Crossover, Mutation, probability of crossover and probability of mutation, convergence
<b>UNIT-IV</b>	<b>HYBRID SYSTEMS:</b> Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems, Case studies : Genetic Algorithm based Backpropagation Network, Fuzzy – Backpropagation, Fuzzy Logic Controlled Genetic Algorithms.
<b>UNIT-V</b>	<b>TOOLS &amp; APPLICATIONS FOR SOFT COMPUTING</b> : Introduction to Tools For Soft Computing –Virtual Lab, Introduction to Fuzzy Logic and GA Tool Boxes of MATLAB.

#### TEXT BOOKS

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
2. Genetic Algorithms: Search and Optimization, E. Goldberg.
3. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI

#### REFERENCE BOOKS

1. Jang, J-S. R., Sun,C-T, Mizutani, E.: “Neuro–Fuzzy and Soft Computing”, Prentice Hall of India. 2002
2. Klir, G. J. and Yuan, B.: "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice Hall. 1995
3. Rajasekaran, S. and Vijayalakshmi Pai, G.A.: “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications”, Prentice Hall of India. 2003
4. Sinha, N.K. and Gupta, M. M. : “Soft Computing and Intelligent Systems - Theory and Applications”, Academic Press. 2000
5. Tettamanzi, A., Tomassini, M.: “Soft Computing: Integrating Evolutionary, Neural, and Fuzzy Systems”, Springer.

#### OPEN EDUCATIONAL RESOURCES

1. NPTEL – Introduction to Soft Computing (IIT Roorkee)
2. Soft Computing – Free Textbook by D.K. Pratihari (NPTEL companion)
3. MIT OCW AI Course (General AI Concepts)

## DISTRIBUTED OPERATING SYSTEM

Course Code: 25CSPE3020	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To know about basic concepts of Distributed operating systems.
2. To provide hardware and software issues in modern distributed systems.
3. To get knowledge in distributed architecture and accessibility of resources in distributed file systems.
4. To learn how to store data in a Distributed File System and Distributed Share memory.
5. To understand naming, synchronization, consistency and replication, fault tolerance, security in DFS.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gain knowledge of distributed operating system architecture.
2. Implement distributed client server applications using remote method invocation.
3. Have knowledge of Synchronization and Deadlock.
4. Have sufficient knowledge about file access.
5. Understand Shared Memory Technique, security, and distributed file systems.

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4, SDG-9, SDG-16**

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
<b>UNIT-I</b>	<b>INTRODUCTION TO DISTRIBUTED SYSTEM</b> Definition, Characteristics of Distributed system, Design issues, Resource sharing and the Web Challenges, System models - Architectural and fundamental models -Networking and internetworking Communication in Distributed system: Layered protocols, ATM networks, Client –Server model, Remote Procedure Calls and Group Communication.

UNIT NUMBER	COURSE CONTENT
UNIT-II	<p><b>CONCURRENCY CONTROL</b>  Clock synchronization, Mutual Exclusion, Election algorithm, the Bully algorithm, a Ring algorithm, Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Comparison - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions</p>
UNIT-III	<p><b>DEADLOCK</b>  Deadlock in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection, Threads, System models, Processors Allocation, Scheduling in Distributed System, Real Time Distributed Systems.</p>
UNIT-IV	<p><b>DISTRIBUTED FILE SYSTEM</b>  Distributed file systems: Distributed file system Design, Distributed file system Implementation, Trends in Distributed file systems. Distributed Shared Memory: What is shared memory, Consistency models, Page based distributed shared memory, shared variables distributed shared memory. Replication in DFS</p>
UNIT-V	<p><b>SECURITY</b>  Overview of security techniques, Cryptographic algorithms ,Digital signatures,Cryptography pragmatics, Replication , System model and group communications, Fault tolerant services, Highly available services , Transactions with replicated data</p>

#### TEXT BOOKS

1. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems, —Principles and Paradigms, Pearson Education, 2002.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, 3rd Edition, Pearson Education, 2002.

#### REFERENCE BOOKS

1. Tanenbaum and Steen, Distributed Systems PHI, 2002.
2. Sape Mullender, Distributed Systems 2nd Edition.
3. Albert Fleishman, Distributed Systems: Software Design and Implementation, Springer Verlag, 1994.

#### OPEN EDUCATIONAL RESOURCES

1. NPTEL – Distributed Systems by Prof. P.K. Biswas (IIT Kharagpur)
2. MIT OCW – Distributed Systems Concepts
3. “Distributed Systems” by Andrew Tanenbaum Free preview
4. AFS Overview – Carnegie Mellon
5. Distributed File Systems Lecture – Georgia Tech
6. Linux NFS Admin Guide – TLDP

<b>SOFTWARE PROJECT MANAGEMENT</b>	
Course Code: 25CSPE3024	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### **COURSE OBJECTIVE**

1. To provide an in-depth understanding of various concepts of Software project phases.
2. To understand the basics of the project management techniques.
3. To learn the feasible solution and optimum solution for resource management. Learn the time estimation and critical path for the project.
4. To learn the various quality models and risk management in resource planning.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.
2. Apply basic concepts related to software project planning, scope and feasibility.
3. Analysis of various project management activities such as tracking, project procurement, configuration management, monitoring.
4. Acquire knowledge about quality assurance, quality control, and risk management.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	CLO1	CLO2	CLO3	CLO4
CO1	✓	✓		
CO2		✓	✓	
CO3			✓	
CO4				✓

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

### **COURSE CONTENTS**

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Introduction and Software Project Planning:</b> Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.
UNIT-II	<b>Project Organization and Scheduling Project Elements:</b> Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle

	and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.
<b>UNIT-III</b>	<b>Project Monitoring and Control:</b> Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.
<b>UNIT-IV</b>	<b>Software Quality Assurance and Testing Objectives:</b> Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.
<b>UNIT-V</b>	<b>Project Management and Project Management Tools Software Configuration Management:</b> Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

#### **TEXT BOOKS**

1. Bob Hughes, Mikecoterrell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.  
Agile, Scrum, closer alignment with modern industry practices, new chapter, more MCQs/exercises Cotterell & Mall Hughes, 6th2017-2018

#### **REFERENCE BOOKS**

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication

#### **OPEN EDUCATIONAL RESOURCES**

1. NPTEL: Software Engineering & Project Management – IIT Kharagpur
2. MIT OpenCourseWare: Software Project Management
3. YouTube – Introduction to SPM (Lectures)
4. GanttProject (Free Tool)
5. PERT/CPM Explained – SlideShare
6. COCOMO Estimation Calculator (Web Tool)

<b>GRID COMPUTING</b>	
Course Code: 25CSPE3026	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To understand introduction and application to Grid Computing.</li> <li>2. To gain knowledge of web services architecture, XML, and related technologies.</li> <li>3. To learn about the Open Grid Services Architecture (OGSA) and its platform components.</li> <li>4. To understand the Open Grid Services Infrastructure (OGSI) and grid service management.</li> <li>5. To comprehend security issues, including trust models, authentication, authorization, and identity management in grid environments.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. Understand the genesis &amp; know the applications of grid computing.</li> <li>2. Understand the technology and tool kits for facilitating grid computing.</li> <li>3. Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.</li> <li>4. Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.</li> <li>5. Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.</li> </ol>

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>		√	√		
<b>CO3</b>				√	
<b>CO4</b>				√	√

**Mapped SDGs: SDG-4, SDG-9, SDG-16**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION AND OVERVIEW OF GRID COMPUTING</b> Early Grid Activities, Current Grid Activities, An Overview of Grid Business Areas, Grid Applications, Grid Infrastructure

<b>UNIT-II</b>	<b>WEB SERVICES AND RELATED TECHNOLOGIES</b> Oriented Architecture, Web Service Architecture, XML, Related Technologies and Their Relevance to Web services, XML Messages and Enveloping, Service Message Web Service Interoperability and the Role of the WS-I Organization, Grid Performance Optimization.
<b>UNIT-III</b>	<b>OGSA</b> Introduction to Open Grid Services Architecture (OGSA), Commercial Data Center- National Fusion Collaboratory, OGSA Platform Components
<b>UNIT-IV</b>	<b>OGSI</b> Introduction-Grid Services, A High-Level Introduction to OGSI, Introduction to Service Data Concepts, Grid Service: Naming and Change Management Recommendations.
<b>UNIT-V</b>	<b>SECURITY</b> Trust models for Grid security environment, Authentication and Authorization methods, Grid security infrastructure, and Identity and access management architecture.

#### **TEXT BOOKS**

1. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005.
2. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann.
3. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.

#### **REFERENCE BOOKS**

1. Barry Wilkinson, "Grid Computing: Techniques and Applications", Chapman and Hall, CRC, Taylor and Francis Group, 2010.  
Focuses on scheduling/resource management and bio-inspired optimization *Mastering Grid Computing* - Ankit 2023-24
2. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.

#### **Open Educational Resources**

1. **Link:** <https://nptel.ac.in/courses/106105016>
2. **Link:** <https://ocw.mit.edu/courses/6-824-distributed-systems-spring-2006/>

<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	
Course Code: 25CSPE3028	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
1. To introduce the concepts of OOP and behavioural modelling.
2. To understand the architectural design methods.
3. To learn the application methodology in a software design.
4. To understand and learn design patterns.
5. To familiarize with the knowledge of design testing in DPIM.

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Demonstrate knowledge of structural and behavioral modeling techniques.
2. Demonstrate knowledge of a model-based software development methodology.
3. Create application of the methodology and the modeling techniques in a significant software design project.
4. Demonstrate knowledge of design patterns and their application in a software design project.
5. Demonstrate knowledge of Design and Testing Process Improvement Models.

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√				
<b>CO2</b>		√			
<b>CO3</b>			√		
<b>CO4</b>				√	
<b>CO5</b>					√

**Mapped SDGs: SDG-4, SDG-9**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> -Introduction to OOP concepts, OO model, analysis, design and implementation.Types of models: Unified Modeling Language(UML) views and basic features, Object-oriented design methodologies, the rational unified process, Object-oriented CASE tools.Introduction to six-level improvement process of design process improvement model (DPIM).

UNIT NUMBER	COURSE CONTENTS
UNIT-II	<p><b>STRUCTURAL &amp; BEHAVIOURAL MODELLING</b> Structural Modeling Techniques Basic Building Blocks -- objects and classes, Structural Composition Techniques, Design Scaling Issues</p> <p><b>Behavioural Modelling</b> : Use Case Diagrams, Interaction Diagrams, Event State Diagrams, Action Matrices, Business Lifecycle Diagrams, Activity Diagrams, Collaboration Diagrams, Rule Specification Techniques, Behavioral Model-Based Reference Architecture for Component Specification.</p>
UNIT-III	<p><b>ARCHITECTURAL MODELLING</b>-Deployment: Common Modelling technique; Modelling processors and devices, modelling distribution of artifacts. Collaboration: Modeling roles, modelling the realization of a Use Case, modelling the realization of an operation, modelling a mechanism</p>
UNIT-IV	<p><b>Design Standards Architectural Patterns:</b> Design Patterns, Program Patterns, Behavioral Design Units Component-Based Specification Techniques</p> <p><b>DPIM - Level One</b> : Requirements Analysis Techniques, Ad Hoc Approach to Design</p> <p><b>DPIM - Levels Two, Three and Four:</b> Design Methodology, Deployment Design Quality Control Properties and Analysis Techniques, Automatic Convertability, Traceability, Standardizability (Design Units/Reusable Patterns), Modularity Changeability (Change Management) ,Scalability of Design Reliability</p>
UNIT-V	<p><b>DPIM - Levels Five and Six</b> : Design Process Management and Optimization Design Metric Models Testing Maturity Model Extended V-Model Testing Techniques <b>OO Testing:</b> Introduction, Object Oriented testing process, testing of analysis and design model, testing of classes.</p>

#### TEXT BOOKS

1. S. R Schach, Introduction to Object Oriented analysis and Design, Mc Graw Hill, 2003
2. Ali Bahrami , "Object Oriented System Development", McGraw Hill International Edition, 1999.
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services

#### REFERENCE BOOKS

1. Booch G., "Object Oriented Analysis and Design", Addison Wesley Publishing Company, 2nd Edition, 2000. 3rd 2007
2. Rumbaugh.J, Blaha. M. Premerlani.W, Eddy F and Loresen W, "Object Oriented Modeling and Design",Prentice Hall of India, 1997.  
Object-Oriented Modeling and Design with UML by Michael Blaha and James Rumbaugh, 2nd edition (Pearson, 2004 & updated 2011)
3. Bennett, S., "Schaum's Outline of UML". New York: McGraw-Hill 2004
4. S. Perdita. "Using UML: Software Engineering with Objects and Components." Addison-Wesley 2000

## **OPEN EDUCATIONAL RESOURCES**

### **NPTEL – Object Oriented Systems Development**

**1. Link:** <https://nptel.ac.in/courses/106105153>

**MIT OpenCourseWare – Software Construction (Partial OOAD)Link:**

<https://ocw.mit.edu/courses/6-005-software-construction-fall-2016/>

**Includes:** OO principles, specification, design, Java-based examples

<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	
Course Code: 25CSPE3030	Continuous Evaluation: 40 Marks
Pre-Requisite : Soft Computing Course	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To provide in depth detail for perceptrons.</li> <li>2. To get familiar with the principles of RBF, RNN, unsupervised learning.</li> <li>3. To learn fuzzy set theory, fuzzy logic and understand the role of uncertainty in real-time applications.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. To introduce methodologies and modelling concepts of ANN. To provide in depth detail of the perceptron.</li> <li>2. To get familiar with the principles of MLP, RBF, Unsupervised learning.</li> <li>3. To understand different types of associative memories, and RNN.</li> <li>4. To learn fuzzy set theory, fuzzy logic and understand the role of uncertainty in realtime applications.</li> <li>5. Utilize fuzzy set theory and fuzzy logic to handle uncertainty in real-time control and decision-making systems.</li> </ol>

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	✓	✓			
<b>CO2</b>			✓		
<b>CO3</b>				✓	✓

**Mapped SDGs: SDG-4,SDG-3, SDG-4, SDG-9 , SDG-11, SDG-17**

## **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (ANN) &amp; SINGLE LAYER PERCEPTRON (SLP)</b> ANN, Modelling of Human Brain and ANN, Types of ANN, activation function, learning tasks and rules. SLP : Basics of Perceptron, McCulloch Pitt NN, Perceptron Convergence Theorem in both Discrete and Continuous Domain, Linearity and Non-Linearity Problem.
<b>UNIT-II</b>	<b>MULTI- LAYER FEED FORWARD NETWORKS</b> Basics of MLP, Generalized Delta Rule, Training Algorithm for MLP, Batch learning, Online Learning, Cross-validation in Back Propagation, Detail Study on Convolution Neural Networks. Basics and need of RBF, Interpolation Problem, RBF networks,
<b>UNIT-III</b>	<b>RECURRENT NETWORKS &amp; ASSOCIATIVE MEMORIES</b> Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, Architecture of Hopfield Network: Discrete and Continuous Neural network applications, Boltzman Machine, R-CNN, LSTM, Unsupervised Learning of clusters.
<b>UNIT-IV</b>	<b>FUZZY SETS, RELATIONS &amp; LOGIC</b> Classical & Fuzzy Set Theory, Fuzzy Relation, Fuzzy Inference System, Fuzzy Logic and approximate reasoning. Fuzzy control System Design Problem, Industrial Applications.
<b>UNIT-V</b>	<b>FUZZY ARITHMETIC &amp; OPTIMIZATION</b> Functions of fuzzy sets, extension principle, fuzzy mapping, interval analysis, vertex method and DSW algorithm. One dimensional fuzzy optimization, fuzzy concept variables and casual relations, fuzzy cognitive maps, agent based models, Crisp logic, Predicate logic

## **TEXT BOOKS**

1. **Introduction to Artificial Neural Systems,- 5<sup>th</sup> Edition** (Jacek M. Żurada, West Publishing,1992).
2. **Neural Networks and Learning Machines, - 3<sup>rd</sup> Edition** (Simon S. Haykin, Pearson,2009)
3. **Principles of Soft Computing, - 3<sup>rd</sup> Edition** (S. N. Sivanandam & S. N. Deepa, Wiley India, 2023).

## REFERENCE BOOKS

1. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
3. S. Rajasekharan and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
4. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", Tata McGraw-Hill Inc. 2000

## OPEN EDUCATIONAL RESOURCES (OERs)

1. Dive into Deep Learning: Available: <https://d2l.ai>
2. Artificial Neural Networks for Beginners – Carlos Gershenson: Available: <https://arxiv.org/abs/cs/0308031>
3. Fuzzy Logic with Engineering Applications – Timothy J. Ross (Preview): Available: [https://books.google.com/books/about/Fuzzy\\_Logic\\_with\\_Engineering\\_Applications.html?id=ZnEoPwAACAAJ](https://books.google.com/books/about/Fuzzy_Logic_with_Engineering_Applications.html?id=ZnEoPwAACAAJ)
4. IIT Patna – Neural Network Basics: Available: <https://www.iitp.ac.in/~ai-nlp-ml/course/dnlp/Neural-Network%28Basics%29.pdf>
5. NPTEL-Soft Computing by Dr. Deepak Garg: Available: <https://nptel.ac.in/courses/106105173>
6. CMU Lecture Notes – MLP: Available: <https://www.cs.cmu.edu/~epxing/Class/10715/lectures/MultiLayerPerceptron.pdf>

<b>CYBER SECURITY</b>	
Course Code: 25CSPE3032	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
<ol style="list-style-type: none"> <li>1. To inform the students about cyber security and its implications.</li> <li>2. To provide students with a practical and theoretical knowledge of cryptography and network security.</li> <li>3. To provide the students' knowledge of different types of attacks on the Network.</li> <li>4. To aware the student about data privacy.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Define the concept of ethical hacking and its associated applications in the Information Communication Technology (ICT) world.
2. Underline the need of digital forensic and the role of digital evidence.
3. Explain the methodology of incident response and various security issues in the ICT world, and identify digital forensic tools for data collection.
4. Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.
5. Apply the knowledge of IDS to secure network and performing router and network analysis.

#### **MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>CO1</b>	√	√			
<b>CO2</b>		√	√		
<b>CO3</b>			√	√	
<b>CO4</b>				√	√

**Mapped SDGs: SDG-4, SDG-9, SDG-16**

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Cyber-attacks, types of attacks, Introduction to cyber security, objectives of security, elements of cyber security, Introduction to Information Security, Introduction to Data and Network Security, Finding vulnerabilities and exploits.

<b>UNIT-II</b>	<b>INTRUSION DETECTION SYSTEMS-</b> Overview of intrusions, system intrusion process, dangers of system intrusions, anomaly detection, misuse detection, types of IDS, the limitations and open problems of intrusion detection systems, Statistical and machine approaches to detection of attacks on computers, Techniques for studying the Internet attacks, network based attacks, host based attacks.
<b>UNIT-III</b>	<b>SECURITY IN CLOUD COMPUTING-</b> What is Cloud Computing, Essential Characteristics, Cloud security challenges, Software as a service security, secure software development life cycle, data usage, data privacy, identity access management, physical security.
<b>UNIT-IV</b>	<b>DATA PRIVACY -</b> Fundamental Concepts, Definitions, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy in different domains- medical, financial, etc.
<b>UNIT-V</b>	<b>CRYPTOGRAPHY -</b> Services, mechanisms and attacks, the OSI security architecture, Network security Model, classical Encryption techniques, Private and Public Key Cryptography.

#### **TEXT BOOKS**

1. Michael T. Goodrich and Roberto Tamassia, "Introduction to Computer Security", Addison Wesley, 2011.
2. B. Raghunathan, "The Complete Book of Data Anonymization: From Planning to Implementation", Auerbach Pub, 2013.
3. John W. Rittinghouse, "Cloud Computing: Implementation Management & Security", CRC Press.
4. William Stallings-"Cryptography and Network Security", Pearson education, 6<sup>th</sup> edition, SBN 10: 0133354695, 2013
5. William Stallings – Computer Security: Principles and Practice, 5th Edition, Pearson Education.
6. William Stallings – Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson Education.
7. William Stallings – Network Security Essentials: Applications and Standards, 7th Edition, Pearson Education

#### **REFERENCE BOOKS**

1. Russell Dean Vines and Ronald L. Krutz , "Cloud Security: A Comprehensive Guide To Secure Cloud Computing", Wiley India Pvt Ltd, 2010.
2. Anderson, James P., "Computer Security Threat Monitoring and Surveillance," Washing, PA, James P. Anderson Co., 1980.
3. L. Sweeney, "Computational Disclosure Control: A Primer on Data Privacy Protection", MIT Computer Science, 2002
4. P.W. Singer – Cybersecurity and Cyberwar: What Everyone Needs to Know, 2nd Edition, Oxford University Press
5. Charles J. Brooks – Cybersecurity Essentials, 2nd Edition, Wiley
6. Kevin Mitnick – The Art of Invisibility, Updated Edition, Back Bay Books
7. Tim Mather – Cloud Security and Privacy, 1st Edition (Reprint 2023), O'Reilly Media
8. Michael Sikorski – Practical Malware Analysis, 1st Edition (Reprint 2023), No Starch Press

### **Open Educational Resources**

- <https://www.youtube.com/c/NetworkChuck>
- <https://www.youtube.com/c/TheCyberMentor>
- <https://www.youtube.com/c/HackerSploit>
- <https://www.youtube.com/c/NullByteWHT>
- <https://www.youtube.com/c/JohnHammond010>
- <https://www.youtube.com/c/lppSec>
- <https://www.youtube.com/c/Cyberspatial>

### **Other Sources**

- <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8858>
- <https://dl.acm.org/journal/tops>
- <https://www.journals.elsevier.com/computers-and-security>
- <https://academic.oup.com/cybersecurity>
- <https://link.springer.com/journal/10207>
- <https://www.journals.elsevier.com/journal-of-information-security-and-applications>
- <http://sdiwc.net/journals/iicsdf/>

## DESIGN THINKING

Course Code: 25CSPE3034	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To provide an overview of an exciting field of design thinking and business processes.
2. To introduce the tools required for design thinking like IBM Blueworks live, IBM Mural
3. To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems.
4. To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
5. To enable students to have skills that will help them to solve complex real-world problems in decision support.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and apply IBM Blueworks live and process designer tool concepts.
3. Understand and analyze design thinking history and its various concepts.
4. Understand, analyze and create models with user collaboration to apply design thinking concepts.
5. Build the process model that is used to implement process application and use different mural templates to apply design thinking concepts for solving real world problem.

### COURSE LEARNING OUTCOME (CLO) - COURSE OBJECTIVE (CO) MAPPING

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

## **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION TO BUSINESS PROCESS MANAGEMENT &amp;AS-IS BUSINESS PROCESS</b> Define business process management (BPM), List and describe the phases in the BPM lifecycle procedure, Define process modeling., Describe how to use IBM Business Process Manager to accomplish process modeling goals, Explain how to create and modify process applications in the Process Center, Create a process application, Explain case management, Describe the purpose and function of Blue works Live, List and describe the core notation elements that are used in IBM Process Designer, Create a business process definition (BPD) from the process and nested process tasks and responsible, Explain how to create and modify process models with the Designer view of the IBM Process Designer.
<b>UNIT-II</b>	<b>PLAYBACK 0: MODELING PROCESS</b> List and describe gateways as they are used in IBM Process Designer, List and describe intermediate event types that are used in IBM Process Designer, Model a business process escalation path with an attached timer intermediate event, Describe the Playback 0 validation goals and requirements, Validate that a process model meets Playback 0 goals and Requirements, Describe IBM Business Process Manager product components, Identify the integrations with other IBM products.
<b>UNIT-III</b>	<b>ENTERPRISE DESIGN THINKING – HISTORY, OVERVIEW-</b> Understand what came before Design Thinking, Identify who did what to bring it about, Learn how it built upon previous approaches, Get an overview of the whole approach to design thinking, Understand the principles, loop, and keys, Determine what is most important.
<b>UNIT-IV</b>	<b>ENTERPRISE DESIGN THINKING –7 KEY HABITS, THE LOOP, USER RESEARCH</b> - Learn 7 key habits of effective thinkers design, Avoid common anti-patterns, Optimize for success with these habits, Understand the importance of iteration, Learn how to observe, reflect, & make, Get ready to drill down & do tomorrow, Understand the importance of user research, Appreciate empathy through listening, Learn key methods of user research.
<b>UNIT-V</b>	<b>ENTERPRISE DESIGN THINKING – MAKE, USER FEEDBACK:-</b> Understand how Make fits into the Loop ,Learn how to leverage Observe information, Learn Ideation, Storyboarding, & Prototyping, Understand user feedback and the Loop, Learn the different types of user feedback, Learn how to carry out getting feedback.
<b>UNIT-VI</b>	<b>PROJECT-</b> Creating Discovery Map, Process Model In Blueworks Live. Adding And Viewing Process Details In Blueworks Live Enterprise Design Thinking - User Research, Reflect, Ideation, Storyboarding, Crafting Hills, Prototyping In Mural.

## **TEXT/REFERENCE BOOKS**

IBM SKILLS ACADEMY



Course Code: 25CSPE3036	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To provide an overview of an exciting field of Predictive Analytics.
2. To introduce the tools required For Predictive Analytics.
3. To review and explore data to look at data distributions and to identify data problems, including missing values.
4. To enable students to have skills that will help them to solve complex real-world problems in decision support.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand and critically apply the concepts and methods of Predictive analytics.
2. Understand and apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.
3. Apply and analyse how to use functions, deal with missing values, use advanced field operations, handle sequence data and improve efficiency.
4. Evaluate the Model on the basis of different Predictive Methods.
5. Build and create advanced analytical models that leverage historical data to uncover real-time insights to predict future events.

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	√

Mapped SDGs: SDG-4, SDG-9

### COURSE CONTENTS

Unit Number	COURSE CONTENTS
UNIT-I	<b>ANALYTICS OVERVIEW</b> Definition of business Analytics with real time examples, How Predictive analytics: Transforming data into future insights, Analytics trends: Past, Present & Future, Towards a Predictive enterprise.

<b>Unit Number</b>	<b>COURSE CONTENTS</b>
<b>UNIT-II</b>	<b>IBM SPSS MODELER &amp; DATA MINING</b> Data Mining applications, Strategy for data mining: CRISP-DM, Identify nodes and streams, The framework of a Data – mining project, Brief the unit of analysis, Explain the type of dialog box.
<b>UNIT-III</b>	<b>UNIT OF ANALYSIS</b> Concepts of Unit of analysis (Distinct, Aggregate, SetToFlag), Integrate data, CLEM Expression, Role of Relationship between two fields, Identifying the modeling objective.
<b>UNIT-IV</b>	<b>ADVANCED DATA PREPARATION WITH IBM SPSS MODELER</b> Functions to enrich data, Method to transform data, Cross-record functions, Sampling, Partitioning and sampling data, Improving Efficiency.
<b>UNIT-V</b>	<b>PREDICTIVE ANALYTICS WITH IBM WATSON STUDIO</b> IBM Watson Studio, Watson studio Components, Data preparation, Watson Machine learning, Data Refinery, Watson Studio Neural Network Modeler, IBM Watson Studio jobs, Use case with AutoAI.
<b>UNIT-VI</b>	<b>PROJECT</b> Predicting using IBM SPSS Modeler & IBM Watson with real Case studies.

<b>TEXT/REFERENCE BOOKS</b>
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IBM Courseware
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<b>Further suggested Readings</b>
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1. IBM Courseware
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2. Predictive Analytics Mesmerizing & fascinating by ERIC SIEGEL
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<b>Open Educational Resources</b>
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1. NPTEL – Data Science for Engineers (Includes Predictive Analytics)
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<b>Link:</b> <a href="https://nptel.ac.in/courses/106106179">https://nptel.ac.in/courses/106106179</a>
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2. edX (Free Audit) – Predictive Analytics Using Python
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<b>Link:</b> <a href="https://www.edx.org/course/predictive-analytics-using-python">https://www.edx.org/course/predictive-analytics-using-python</a>
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<b>BUSINESS INTELLIGENCE</b>
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Course Code: 25CSPE3038
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Continuous Evaluation: 40 Marks
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Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVES

1. To introduce students to the foundational concepts, components, and significance of Business Intelligence (BI) in decision-making.
2. To equip students with practical skills in data integration and transformation using open-source ETL tools.
3. To provide hands-on understanding of data warehousing and OLAP operations using open-source platforms.
4. To train students in designing dynamic dashboards and reports using modern open-source BI visualization tools.
5. To develop critical thinking by exploring real-world BI case studies using both legacy and modern tools across industries.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Describe the architecture, functions, and scope of Business Intelligence systems.
2. Apply ETL processes using open-source tools for real-world data preparation tasks.
3. Design and implement data warehouse schemas and perform OLAP operations.
4. Develop interactive dashboards and schedule reports using visualization platforms.
5. Analyze and compare legacy and modern BI solutions in various industry contexts.

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05	√			√	√

Mapped SDGs: SDG-4, SDG-8, SDG-9, SDG-11, SDG-16

### COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	<p><b>Introduction to Business Intelligence</b>  Definition and significance of Business Intelligence (BI),Key components of BI,Data Sources: structured and unstructured,Data Integration (Extract-Transform-Load (ETL)/ ELT) processes,Data Storage: Data Warehousing, Data Lakes,and Data Lakehouses,Reporting, Dashboards and Visualization, Comparison with related fields:BI vs Data Analytics, BI vs Data Mining,Role of BI in informed decision-making, Applications across industries: retail, banking, healthcare, and logistics</p> <p><b>Career pathways and future trends in BI</b></p>

<p style="text-align: center;"><b>UNIT-II</b></p>	<p><b>Data Acquisition, Preparation and Cloud Integration</b>  <b>Tools Used:</b> Python with Pandas (for data manipulation, cleaning, basic ETL scripting), SQL (for data extraction and transformation within databases), or KNIME or Talend Open Studio (For visual ETL workflow)  <b>Primary Topics:</b>Introduction to open-source ETL tools,Cloud Data Integration concepts,Practical data preparation pipelines,Combining multiple data sources,Data type handling and formatting  <b>Tutorial Exercises:</b></p> <ol style="list-style-type: none"> <li>1. Build an ETL pipeline to extract, clean, transform, and load employee data from a CSV/JSON file.</li> <li>2. Merge product and sales data from different sources (e.g., a database and an API endpoint), handle data inconsistencies, and export in a unified, clean format.</li> <li>3. Implement data validation rules within an ETL process to ensure data quality.</li> </ol>
<p style="text-align: center;"><b>UNIT-III</b></p>	<p><b>Data Warehousing and Online Analytical Processing</b>  <b>Tool Used:</b> Apache Kylin or Pentaho Community Edition  <b>Primary Topics:</b>Fundamentals of Data Warehousing Designing a warehouse schema</p> <ul style="list-style-type: none"> <li>● Introduction to Online Analytical Processing (OLAP)</li> <li>● Cube building and multidimensional queries</li> <li>● Introduction to Cloud Data Warehouses</li> <li>● Data Lake vs. Data Warehouse vs. Data Lakehouse</li> <li>● Data Governance in Data Warehousing</li> </ul> <p><b>Tutorial Exercises:</b></p> <ol style="list-style-type: none"> <li>1. Design a star schema for a university admissions dataset and implement it in Pentaho.</li> <li>2. Load transformed data into the designed data warehouse.</li> <li>3. Create an OLAP cube and perform slice-and-dice and drill-down operations on student data.</li> </ol>
<p style="text-align: center;"><b>UNIT-IV</b></p>	<p><b>Interactive Data Visualization and Reporting</b>  <b>Tools Used:</b> Microsoft Power BI (for comprehensive dashboarding, AI features, integration), Tableau (for advanced visualization), Metabase or Apache Superset  <b>Primary Topics:</b>Concepts of effective data visualization,Data Storytelling,Using open-source BI reporting tools,Creating user-interactive dashboards,Key Performance Indicators (KPIs) and Metrics Design,Scheduling and automating reports,Introduction to AI-Powered Visualization  <b>Tutorial Exercises:</b></p> <ol style="list-style-type: none"> <li>1. Design and build an interactive sales performance dashboard in Microsoft Power BI, incorporating multiple data sources, filters, and drill-down capabilities.</li> <li>2. Create a compelling data story and a series of linked visualizations in Tableau to analyze customer behavior or market trends.</li> <li>3. Connect a database and schedule an automated weekly report with performance KPIs.</li> </ol>
<p style="text-align: center;"><b>UNIT-V</b></p>	<p style="text-align: center;"><b>Case Studies in Real-World BI Systems</b></p>

	<p><b>Healthcare BI:</b>  <i>Legacy System: SAP BusinessObjects</i> – used for hospital operations, static patient data reporting  <i>Modern System: Tableau</i> – widely used for real-time clinical dashboards and public health analytics</p> <p><b>Retail BI:</b>  <i>Legacy System: IBM Cognos Analytics</i> – traditionally used for structured reporting and sales KPIs  <i>Modern System: Microsoft Power BI</i> – leading tool for dynamic dashboards, product analytics, and customer behavior insights</p> <p><b>Government BI:</b>  <i>Legacy System: SAS Business Intelligence</i> – used in public administration for population data analysis and program evaluation  <i>Modern System: Qlik Sense</i> – popular in government agencies for fraud detection, service optimization, and real-time insights</p> <p>Discussion:  Architectural shift from monolithic reporting systems to cloud-enabled interactive platforms  Benefits of modern systems: scalability, user accessibility, real-time integration  Key concerns: data privacy, transparency, interoperability, ethical use in automated decision-making</p>
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#### TEXT BOOKS

1. “Business Intelligence: A Managerial Perspective on Analytics” by Ramesh Sharda, Dursun Delen, Efraim Turban in Pearson Education .
2. “Data Warehousing for Business Intelligence” by Paul Raj Ponniah in Wiley

#### REFERENCE BOOKS

1. “Successful Business Intelligence: Unlock the Value of BI & Big Data” by Cindi Howson in McGraw-Hill.
2. “Learning Pentaho BI Suite” by María Carina Roldán in Packt Publishing

#### Open Educational Resources

1. **NPTEL – Business Analytics and Data Mining Modeling Using R**  
**Link:** <https://nptel.ac.in/courses/110106064>
2. **Saylor Academy – Data Analysis and Decision-Making**  
**Link:** <https://learn.saylor.org/course/view.php?id=98>

#### INTERNET OF THINGS

Course Code: 25CSPE3040	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
1. To understand and learn about various protocols of IoT, sensors and their types.
2. To develop schemes for the applications of IoT in real time scenarios.
3. To design business Intelligence and Information Security for IoT

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of IoT and communication protocols from a global context.
2. Understand and apply IoT protocols.
3. Apply and analyze sensor networks and their components to the IoT domain.
4. Design portable IoT using appropriate boards.
5. Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.
6. Build and create state of the art architecture in IoT.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>
<b>CO1</b>	√	√				
<b>CO2</b>			√	√		
<b>CO3</b>					√	√

**Mapped SDGs: SDG-3, SDG-4, SDG-9, SDG-11**

### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>CONTENTS</b>
<b>UNIT-I</b>	<b>Introduction to IoT:</b> Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensing: Sensors and Transducers, Sensor Classes, Sensor Types, Actuation: Actuator Basics, Actuator Types <b>Basics of IoT Networking:</b> IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP, AMQP (Advanced Message Queuing Protocol).
<b>UNIT-II</b>	<b>IoT Protocols:</b> Protocol Standardization for IoT-M2M and WSN Protocols. <b>Connectivity Technologies:</b> IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave, ISA100.11a
<b>UNIT-III</b>	<b>Sensor Networks:</b> Basic Concepts, Wireless Sensor Networks, Sensor Nodes, Node Behaviour, Social Sensing, Application Examples, Target Tracking, Wireless Multimedia Sensor Networks, Coverage, Mobile Wireless Sensor Networks and their Applications, UAV (Unmanned Aerial Vehicle) Networks, Machine to Machine Communication, Interoperability in Internet of Things

UNIT NUMBER	CONTENTS
UNIT-IV	<b>Introduction to Arduino:</b> Basic Concepts of Arduino Platform, Examples of Arduino Programming, Integration of Sensors and Actuators with Arduino, <b>Introduction to Raspberry Pi</b> , Implementation of IoT with Raspberry, Software Defined Networking, Software Defined IoT Networking
UNIT-V	<b>Cloud Computing:</b> Fundamentals, Service Models, Service Management and Security, Case Studies, Open Source Platform, Sensor Cloud, Fog Computing, <b>Application Domains of IoT :</b> Smart Cities: Need for Smart Cities, Challenges in Building Smart Cities, Some Technical Issues behind Enabling Smart Cities, Smart Homes: Home Area Networks (HANs), Connected Vehicles, Smart Grid, Industrial IoT, Data Handling and Analytics, Case Study: Agriculture, Healthcare, Activity Monitoring,
UNIT-VI	<b>PROJECT-</b> Research Activities on IoT with projects and research letters.

#### TEXT BOOKS

1. Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" -- CRC Press-2012
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
3. Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer-2011.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things - Key applications and Protocols", Wiley, 2012.
5. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

#### REFERENCE BOOKS

1. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

#### Open Educational Resources

1. NPTEL - Introduction to Internet of Things  
Link: <https://nptel.ac.in/courses/106105166>
2. OpenLearn - Internet of Everything (IoE) Link:  
<https://www.open.edu/openlearn/science-maths-technology/internet-everything/content-section-overview>

<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	
Course Code: 25CSPE4019	Continuous Evaluation: 40 Marks

Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To know the various art of the security exploitation
2. To learn secure programming techniques
3. To understand the mathematics behind cryptography
4. To know the standard algorithms used to provide confidentiality, integrity and authenticity
5. To learn the public key infrastructure that will be used for security practices

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Present the exploitation present in the security.
2. Discuss various types of attacks and their characteristics.
3. Illustrate the basic concept of encryption and decryption for secure data transmission.
4. Analyze various cryptography techniques and its applications.
5. Develop solutions for security problems.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5
<b>CO1</b>	√	√			
<b>CO2</b>		√	√		
<b>CO3</b>			√		
<b>CO4</b>				√	√
<b>CO5</b>					√

**Mapped SDGs: SDG-4, SDG-9, SDG-16**

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>FUNDAMENTALS- Security trends</b> - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.
UNIT-II	<b>SYMMETRIC KEY CRYPTOGRAPHY- MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY:</b> Algebraic structures - Modular arithmetic-Euclid’s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- <b>SYMMETRIC KEY CIPHERS:</b> DES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.
UNIT-III	<b>PUBLIC KEY CRYPTOGRAPHY</b> <b>MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY:</b> Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - <b>ASYMMETRIC KEY CIPHERS:</b> RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.
UNIT-IV	<b>MESSAGE AUTHENTICATION AND INTEGRITY</b> Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509
UNIT-V	<b>SECURITY PRACTICE AND SYSTEM SECURITY</b> Electronic Mail security – PGP, S/MIME – IP security – Web Security - <b>SYSTEM SECURITY:</b> Intruders – Malicious software – viruses – Firewalls.

#### TEXT BOOKS

1. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, Starch Press, 2008.
2. William Stallings, “Cryptography and Network Security: Principles and Practices”, Sixth Edition, Pearson Education, 2014.

#### REFERENCE BOOKS

1. “The Shellcoder’s Handbook: Discovering and Exploiting Security Holes”, 2nd Edition by Chris Anley et al.
2. N. Ferguson, B. Schneier, and T. Kohno. “Cryptography Engineering: Design Principles and Practical Applications”. Wiley, 2010.
3. Neil Daswani, Christoph Kern, and Anita Kesavan, “Foundations of Security: What Every Programmer Needs to Know”, First Edition, Apress, 2007.
4. SNMP: A Guide to Network Management (MGH).
5. Telecom Network Management by H.H. Wang (MGH).

6. Network Management by U. Dlack (MGH).

**Open Educational Resources**

**1. NPTEL – Cryptography and Network Security**

**Link:** <https://nptel.ac.in/courses/106105031>

**2. NPTEL – Computer Networks and Internet Protocol (with Security Modules)**

**Link:** <https://nptel.ac.in/courses/106105183>

<b>SOFTWARE TESTING</b>	
Course Code: 25CSPE4033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVES</b>
<ol style="list-style-type: none"> <li>1. To understand the fundamentals and significance of software testing.</li> <li>2. To apply various white-box and black-box testing techniques in practice.</li> <li>3. To analyze software testing levels and debugging strategies.</li> <li>4. To explore the process and tools for software test automation.</li> <li>5. To evaluate software quality through testing strategies and tools in real-world applications.</li> </ol>

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
<ol style="list-style-type: none"> <li>1. Demonstrate understanding of software testing principles with real-world examples.</li> <li>2. Apply appropriate testing techniques including white-box and black-box methods.</li> <li>3. Analyze software at various levels of testing and perform debugging.</li> <li>4. Identify, classify, and resolve software bugs through systematic testing approaches.</li> <li>5. Perform and document test strategies while managing trade-offs between testing methods.</li> <li>6. Implement and experiment with software test automation tools and frameworks.</li> </ol>

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>
<b>CO1</b>	√				√	
<b>CO2</b>		√			√	
<b>CO3</b>			√	√		
<b>CO4</b>						√
<b>CO5</b>				√		√

**Mapped SDGs: SDG-4, SDG-8, SDG-9,SDG-12**

### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b>INTRODUCTION</b> Introduction to software testing and its challenges, Basic Definitions: Error, Fault, Failure, Incident, Test Cases, Overview of the Software Testing Process and limitations of testing.

UNIT NUMBER	COURSE CONTENTS
<b>UNIT-II</b>	<p><b>TESTING TECHNIQUES</b>  White-Box and Black-Box Testing, Boundary Value Analysis, Equivalence Class Testing, Decision Table-Based Testing, Cause-Effect Graph Technique, Cyclomatic Complexity Analysis, Data Flow Testing, Control flow Testing.</p>
<b>UNIT-III</b>	<p><b>REDUCING THE NUMBER OF TEST CASES</b>  Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing.  <b>Testing Activities:</b> Unit Testing, Levels of Testing, Integration Testing, Debugging, Domain Testing.</p>
<b>UNIT-IV</b>	<p><b>SYSTEM AND NON-FUNCTIONAL TESTING</b>  Verification and Validation Testing, Alpha Testing, Beta Testing, Stress Testing, Load Testing, Volume Testing, Usability testing, Bug, Bug life cycle  Introduction to Non-Functional Testing, Challenges in non-functional testing, Introduction to Performance and Security Testing</p>
<b>UNIT-V</b>	<p><b>AUTOMATED TESTING TOOLS AND AGILE TESTING</b>  Test Automation: Scope of Automation, Process Model for Automation, Challenges in Automation, Static Testing Tools, Dynamic Testing Tools, Tools for Functional and Non-Functional Testing (e.g., Selenium) Basics of Agile and DevOps Testing.</p>

#### TEXT BOOKS

1. Software Testing: Principles and Practices, Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education.
2. Software Testing: Principle, Techniques and Tools, M. G. Limaye, Tata McGraw Hill, 2017.
3. Effective Methods for Software Testing, William E. Perry, John Wiley and Sons, 3rd Edition

#### REFERENCE BOOKS

1. An Integrated Approach to Software Engineering, Pankej Jalote, Narosa Publishing House, New Delhi 2005.
2. The Art of Software Testing, Glenford J. Myers, John Wiley & Sons, 2012.
3. Software Testing: Software Testing: A Craftsman's Approach (4th ed.)
4. Software Testing Techniques, Boris Beizer, Dreamtech, 2006.
5. Effective Software Testing: 50 Specific Ways to Improve Your Testing, Dustin, Pearson Education, 2002.

#### OPEN EDUCATIONAL RESOURCES (OERs)

1. Software Testing: Foundations (4th ed.) by Spillner, Linz & Schaefer – Free ISTQB-aligned PDF ICDST E-print Archive
2. Introduction to Software Testing – Public domain PDF from Computer eBooks Google Books+15All Free Stuff Ebooks+15CampusBooks+15
3. MIT OpenCourseWare & VHB – Introductory test methodologies available as open modules
4. “Software Testing Foundations” (Spillner, Linz & Schaefer, 4th ed., ISTQB)

#### Journals (free access or open access):

1. [Journal of Software: Evolution and Process](#)

2. [Software Testing, Verification and Reliability \(Wiley\)](#)
3. [Empirical Software Engineering Journal \(Springer, OA articles\)](#)

<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	
Course Code: 25CSPE4023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
1. To cover major aspects of ad hoc and sensor networking, from design through performance issues to application requirements.
2. To start with the design issues and challenges associated with implementations of ad hoc and sensor network applications. This includes mobility, disconnections, and battery power consumption.
3. To provide a detailed treatment of proactive, reactive, and hybrid routing protocols in mobile wireless networks. It also covers the IEEE 802.11 Wireless LAN and Bluetooth standards and discusses their characteristics and operations.
4. To cover wireless sensor networks (architecture, design, protocols, and applications).
5. To give students hands-on experience in designing a mobile ad hoc network using the NS2 network simulator.

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.
2. Familiarize yourself with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.
3. Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).
4. Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.
5. Understand the congestion control mechanism at the transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	√				
<b>C02</b>		√	√		
<b>C03</b>				√	
<b>C04</b>				√	√
<b>C05</b>					√

**Mapped SDGs: SDG-4, SDG-9, SDG-11**

#### **COURSE CONTENTS**

UNIT NUMBER	CONTENTS
UNIT-I	<b>AD HOC Wireless-</b> Introduction, Mobile Ad Hoc Networks, Technologies for Ad Hoc Network, Issues in Ad hoc wireless Networks IEEE 802.11 Architecture and protocols. Protocol for AD HOC Wireless Networks. Issues and classification of MAC protocol, Dynamic Source Routing (DSR), Adhoc Distance Vector (AoDV) routing, Routing Protocols, Application of Ad Hoc and sensor networks
UNIT-II	<b>Transport Layer &amp; Security Protocols-</b> Issues in designing transport layer protocols, classification of transport layer solutions, TCP over Ad Hoc Wireless Networks, Network Security requirements and Attacks
UNIT-III	<b>Wireless Sensor Networks</b> Basic Sensor Network Architectural Elements, Applications of Sensor Networks, Comparison with Ad Hoc Wireless Networks, Challenges and Hurdles. Architecture of WSNs Hardware components, Operating systems and execution environments, some examples of sensor nodes, Network Architecture, Sensor networks scenarios, Optimization goals and figures of merit Design principles for WSNs.
UNIT-IV	<b>Communication Protocols -</b> Physical Layer and Transceiver design considerations in WSNs, Fundamentals of (wireless) MAC protocol, Address and name management in wireless sensor networks, Localization and positioning Routing protocols Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless, Routing Strategies in Wireless Sensor Networks
UNIT-V	<b>Transport &amp; QoS in WSN</b> -Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples
UNIT-VI	<b>PROJECT-</b> Research Activities and hands-on experience in designing a mobile ad hoc network using the NS2 network simulator

#### TEXT BOOKS

1. C. S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India , 2007.
2. Andreas Willig and John H. Karl, Protocols & Architectures for Wireless Sensor Networks, Wiley, 2005

#### REFERENCE BOOKS

1. B. Tavli and W. Heinzelman, Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications, Springer , 1st Edition, 2006
2. Ramin Hekmat, Ad-hoc Networks: Fundamental Properties and Network Topologies, Springer , 1st Edition, 2006

#### OPEN EDUCATIONAL RESOURCES (OERs)

**1. NPTEL – Wireless Ad Hoc and Sensor Networks**

**Link:** <https://nptel.ac.in/courses/106105160>

**Instructor:** Prof. Sudip Misra (IIT Kharagpur)

**Topics:** MANETs, WSN architecture, routing protocols, MAC layer, QoS

**2. NPTEL – Sensor Networks and Internet of Things**

**Link:** <https://nptel.ac.in/courses/106105173>

**Instructor:** Prof. Prabhakar T.V. (IISc Bangalore)

**Topics:** WSN node design, communication, energy issues, IoT integration

## ADVANCED JAVA PROGRAMMING

Course Code: 25CSPE4035	Continuous Evaluation: 40 Marks
Pre-Requisite : Core Java Programming	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVES

1. To develop graphical programs with networking functionality. Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.
2. To design and develop GUI applications using Swing and Event Handling.
3. To design and develop Web applications.
4. To understand designing of distributed applications using Remote Method Invocation (RMI)

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Learn the graphics and animation on the web pages, using Java Applets.
2. Learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings Usage.
3. Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.
4. Learn and design the server side programming using Servlets and JSP
5. Use the invocation of the remote methods in an application using RMI.

### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√	√			
CO2			√		
CO3				√	
CO4					√

Mapped SDGs: SDG-4, SDG-9

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>INTRODUCTION TO ADVANCED JAVA</b> Java Streaming – Components and events handling – Threading concepts – Networking features – Byte code interpretation – Media Techniques.
UNIT-II	<b>SWINGS</b> Introduction to swings, difference between AWT and Swings, java foundation classes, java swings classes.

UNIT NUMBER	COURSE CONTENTS
UNIT-III	<b>ADVANCED NETWORKING</b> Client- Sever computing – Sockets – Content and Protocols handlers – Developing distributed applications – RMI – Remote objects – Object serialization
UNIT-IV	<b>REMOTE METHOD INVOCATION</b> Remote Method Invocation (RMI): RMI Architecture, Designing RMI application, Executing RMI application.
UNIT-V	<b>RELATED JAVA TECHNIQUES</b> 3D graphics – JAR file format and creation – Internationalization. <b>SERVLETS</b> Java Servlets: Servlet Interaction & Advanced Servlets, Life cycle of Servlet, Java Servlet Development Kit, Javax.servlet package, Reading Servlet Parameters, Reading Initialization Parameters, The javax.servlet. http Package, Handling HTTP.

#### TEXT BOOKS

Jame Jaworski, *“Java Unleashed”*, SAMS Techmedia Publications, 1999.  
 H.M.Deitel and P.J.Deitel, *“Java how to program with an Introduction to Visual J++”*, Pearson Education, 1998.  
 Java: The Complete Reference, Ninth Edition Paperback by Herbert Schildt  
 Advanced Java Programming, Uttam Kumar, Oxford Publications.

#### REFERENCE BOOKS

Campione, Walrath and Huml, *“The Java Tutorial”*, Addison Wesley, 1999.  
 Duane A.Bailey, *“Java Structures”*, McGraw-Hill Publications, 1999.  
 Jeff Frentzen and Sobotka, *“Java Script”*, Tata McGraw-Hill, 1999.  
 Jamie Jaworski, *“Java Unleashed”*, SAMS Techmedia Publication, 1999.  
 Jason Bloomberg. Jeff Kowski, and Paul Treffers, *“Web Page Scripting Techniques”*, Hayden books, 1996.

#### OPEN EDUCATIONAL RESOURCES (OERs)

- 1. NPTEL – Programming in Java (Includes Advanced Topics)**  
**Link:** <https://nptel.ac.in/courses/106105191>  
**Instructor:** Prof. Debasis Samanta (IIT Kharagpur)  
**Topics:** JDBC, JavaBeans, Multithreading, Networking, GUI (Swing), Servlets
- 2. Coursera (Free Audit) – Advanced Java Programming**  
**Link:** <https://www.coursera.org/learn/advanced-java-programming>  
**Institution:** LearnQuest  
**Topics:** Java Networking, RMI, JDBC, Servlets, JSP  
**Type:** Videos + Assignments + Certificate (paid option)

**NASSCOM ASSOCIATE ANALYTICS - II**

Course Code: 25CSPE4037	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

**COURSE OBJECTIVE**

1. To provide knowledge of the tools, technologies & programming languages which are used in day to day business analytics cycle.

**COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

**COURSE CONTENTS**

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Data Management &amp; Introduction to Big Data Tools (NOS 2101)</b> Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/signal/GPS etc. Export all the data onto Cloud ex. AWS/Rackspace etc. Introduction to Big Data tools like Hadoop, Spark, Impala etc., Data ETL process, Identify gaps in the data and follow-up for decision making.
UNIT-II	<b>Big Data Analytics &amp; Machine Learning Algorithms (NOS 2101)</b> Run descriptive' s to understand the nature of the available data, collate all the data sources to suffice business requirement, Run descriptive statistics for all the variables and observe the data ranges, Outlier detection and elimination. Hypothesis testing and determining the multiple analytical methodologies, Train Model on 2/3 sample data using various Statistical/Machine learning algorithms, Test model on 1/3 sample for prediction etc.
UNIT-III	<b>Data Visualization (NOS 2101)</b> Prepare the data for Visualization, Use tools like Tableau, QlickView and D3, Draw insights out of Visualization tool.
UNIT-IV	<b>Maintain Healthy, Safe &amp; Secure Working Environment (NOS 9003)</b> Introduction, workplace safety, Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, assessment
UNIT-V	<b>Provide Data/Information in Standard Formats (NOS 9004)</b> Introduction, Knowledge Management, Standardized reporting & compliances, Decision Models, course conclusion. Assessment

**TEXT/REFERENCE BOOKS**

NASSCOMM

<b>DATA WAREHOUSING &amp; DATA MINING</b>	
Course Code: 25CSPE4025	Continuous Evaluation: 40 Marks

Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### **COURSE OBJECTIVE**

1. To introduce the concepts, architecture, and applications of data warehousing and data mining.
2. To develop the ability to preprocess data and apply OLAP operations and dimensional modeling for business analysis.
3. To explore and implement core data mining techniques such as classification, prediction, clustering, and association rule mining.
4. To apply mining methods to complex data types including spatial, multimedia, text, and web data.
5. To evaluate and deploy data mining models effectively in real-world and decision-support applications.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the architecture and components of data warehousing and data mining systems, including OLAP operations.
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction to prepare analytical datasets.
3. Analyze and implement classification and prediction models such as decision trees, Bayesian classifiers, and support vector machines.
4. Discover patterns and associations using frequent itemset mining and constraint-based association rule techniques.
5. Perform cluster analysis using partitioning, hierarchical, density-based, and model-based clustering methods.
6. Describe complex data types and apply mining techniques to spatial, multimedia, text, and web data.
7. Evaluate and apply data mining models in real-time applications for decision support and knowledge extraction.

### **COURSE LEARNING OUTCOME (CLO) - COURSE OBJECTIVE (CO) MAPPING**

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO7
C01	✓						
C02		✓					
C03			✓	✓	✓		✓
C04						✓	
C05			✓	✓	✓	✓	✓

**Mapped SDGs: SDG-4, SDG-8, SDG-9,SDG-17**

### **COURSE CONTENTS**

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>DATA WAREHOUSING AND BUSINESS ANALYSIS:</b> Introduction to Data Warehousing, Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata in DW, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.
UNIT-II	<b>DATA MINING:</b> Data Mining Functionalities, Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation, Architecture Of a Typical Data Mining Systems, Classification Of Data Mining Systems. Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint-Based Association Mining.
UNIT-III	<b>CLASSIFICATION AND PREDICTION:</b> Introduction to Classification and Prediction, Classification by Decision Tree, Introduction to Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods, Model Section.
UNIT-IV	<b>CLUSTER ANALYSIS:</b> Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.
UNIT-V	<b>MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA:</b> Multidimensional Analysis and Descriptive Mining of Complex Data Objects, mining of structured and semi-structured data, Spatial Data Mining, Multimedia Data Mining: image, audio, and video data, Text Mining: from unstructured textual content, Mining the World Wide Web: analysing web structure, usage, and content.

#### TEXT BOOKS

1. Han, J., Pei, J., & Tong, H. (2022). *Data Mining: Concepts and Techniques* (4th ed.). Morgan Kaufmann.
2. Sam Anahory, Dennis Murray – *Data Warehousing in the Real World*, Pearson Education.
3. Arun K. Pujari – *Data Mining Techniques*, Universities Press.

#### REFERENCE BOOKS

1. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar – *Introduction to Data Mining*, 2nd Edition, Pearson.
2. Paulraj Ponniah – *Data Warehousing Fundamentals for IT Professionals*, Wiley India.
3. Margaret H. Dunham, S. Sridhar – *Data Mining: Introductory and Advanced Topics*, Pearson Education.
4. W.H. Inmon – *Building the Data Warehouse*, John Wiley & Sons.
5. Alex Berson, Stephen J. Smith – *Data Warehousing, Data Mining and OLAP*, McGraw Hill.
6. *Developing the Data Warehouses-* W.H Ionhman, C.Klelly, John Wiley & Sons.

7. Managing the Data Warehouses- W.H.Inman, C.L.Gassey, John Wiley & Sons.

OPEN EDUCATIONAL RESOURCES

1. MIT OpenCourseWare (OCW) – Data Mining [MIT OCW Machine Learning](#)
2. MERLOT Collection [MERLOT – Data Mining](#)
3. OER Commons [OER Commons – Data Mining Resources](#)

Course Code: 25CSPE4027	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To provide knowledge of concepts, models, condition of the mobile user and architecture of Mobile networks.
2. To learn about various mobile computing Models and to study about various routing protocols that are suitable for mobile networks.
3. To understand the concept of mobile agents and their applications.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Grasp the concepts and features of mobile computing technologies and applications.
2. Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support
3. Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3
C01	√		
C02		√	
C03			√

Mapped SDGs: SDG-9, SDG-11, SDG-13

### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>Overview of Ad Hoc Networks:</b> Introduction to Mobile Computing –Challenges and Applications of Mobile Computing- Frequencies for radio transmission- Antennas -Multiplexing — Spread spectrum -MAC Protocols: SDMA- TDMA- FDMA- CDMA. Introduction to Cellular Systems — GSM: Architecture, Services & Protocols-GPRS-Radio frequency identification(Rfid)-Wireless Broadband- Introduction to 1G, 2G, 3G and 4G: features and challenges, Applications of 4G.
UNIT-II	<b>Wireless and Mobile Computing Models</b> -LAN Protocols: IEEE 802.11/a /g/n & Bluetooth, Data Management Issues. Sensor Networks- Challenges, Architecture, and Applications.

<b>UNIT-III</b>	<b>Routing in Mobile Networks-</b> Routing Taxonomy, Applications, Challenges in Mobile Environments, Hidden and exposed terminal problems, Routing Protocols- Proactive, Reactive, and Hybrid protocols, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV), and Cluster Based Routing Protocol (CBRP), and Temporally Ordered Routing algorithm (TORA), Directed-diffusion, Low Energy Adaptive Clustered Hierarchical (LEACH) routing protocol.
<b>UNIT-IV</b>	<b>Mobile TCP/IP</b> -Distributed location and data management: Mobile IP- Problem with Mobility, Terminology, Operation, Tunneling, Data transfer to the mobile system, Transport Control Protocol (TCP) Over wireless- Indirect TCP (I-TCP), Snoop TCP, Mobile TCP (M-TCP), Data management issues, Data delivery models, Broadcast disks, data replication, Data caching and design issues, Air indexing, Transaction processing in mobile computing environment.
<b>UNIT-V</b>	<b>MOBILE AGENTS</b> Introduction to Mobile Agents, Mobile agents vs. Client server, Agent migration and design issues, Mobile agent communication, Mobile Agent Security – Security Requirements and Cryptographic Techniques, Taxonomy of Possible Attacks – Malicious Agents, Malicious Agencies, Protecting Mobile Agents - Preventing Attacks on Mobile Agents, Detecting Attacks on Mobile Agents, Protecting Agencies - Agent Authentication and Authorization.

#### **TEXT BOOKS**

Charles E. Perkins, Ad hoc Networks, Addison Wesley, 2008.

Mazliza Othman, Principles of mobile computing and communications, Auerbach Publications, 2007.

#### **REFERENCE BOOK**

1. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
2. Wireless Communications & Networks, Second Edition, William Stallings by Pearson
3. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition, TMH

#### **OPEN EDUCATIONAL RESOURCES (OERs)**

##### **1. NPTEL – Mobile Computing**

**Link:** <https://nptel.ac.in/courses/106106147>

**Instructor:** Prof. Kumaravelu S (IIT Madras)

**Topics:** GSM, GPRS, 3G/4G, mobile TCP, MAC protocols, mobile IP

##### **2. NPTEL – Wireless and Mobile Networks**

**Link:** <https://nptel.ac.in/courses/106105081>

**Instructor:** Prof. Bhaskaran Raman (IIT Bombay)

**Topics:** Mobility models, wireless TCP, adhoc routing, sensor networks

<b>MACHINE LEARNING USING R</b>	
Course Code:25CSPE4029	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

<b>COURSE OBJECTIVE</b>
1. To learn the basics of R programming and understands the role of mathematics in machine learning.
2. To identify potential application domains of machine learning in practice.
3. To describe the differences in approaches and applicability of regression, classification, clustering, clustering and transfer learning.
4. To be able to select machine learning task for a given application.
5. To and can build an application based on machine learning.

<b>COURSE LEARNING OUTCOMES (CLO)</b>
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Learn the fundamentals of R-programming and probability.
2. Understand the basics and need of Machine learning in global view.
3. Demonstrate in-depth knowledge of methods and theories in the field of machine learning.
4. Understand, apply and evaluate the supervised learning techniques.
5. Apply, analyze and evaluate the ensemble learning and unsupervised learning techniques
6. Understand the concepts of reinforcement learning and transfer learning.
7. To implement the machine learning techniques for building different applications.

#### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>	<b>CLO6</b>	<b>CLO7</b>
<b>CO1</b>	√						
<b>CO2</b>		√	√				
<b>CO3</b>				√	√	√	
<b>CO4</b>							√
<b>CO5</b>							√

**Mapped SDGs: SDG-4, SDG-9, SDG-11**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>INTRODUCTION TO R AND PROBABILITY :</b> <i>R basics</i> – Math, Variables and strings, Vectors and Factors, Vector operations, Data Structure in R - Arrays & Matrices, Lists & Data frames, Conditions and Loops, functions in R, Objects & Classes, Debugging, R programming Fundamentals:- Conditions and loops, Functions in R, Objects and Classes, Debugging, Basics of probability and distribution function.
UNIT-II	<b>INTRODUCTION TO MACHINE LEARNING :</b> Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques, Machine Learning Models, Data- pre-processing and feature Engineering
UNIT-III	<b>SUPERVISED LEARNING:</b> <i>Machine learning Algorithms for classification problem:</i> Decision Trees, K-NN, SVM, Naïve Bayes Classifier, Bayesian learning, Bayesian network. <i>Regression :</i> Linear , Logistic, Ridge, Regularization, Bias/ Variance Tradeoff,
UNIT-IV	<b>ENSEMBLE AND UNSUPERVISED LEARNING:</b> Bagging, Boosting, Random forest, <i>Clustering:</i> K-means, Heirarchical clustering, Partitional clustering, Apriori algorithm, FP growth, Validation Techniques in clustering.
UNIT-V	<b>REINFORCEMENT AND TRANSFER LEARNING:</b> Components of an RL – (Agent, Policy, Value function, Model), MDP, DP, TDL, Q-Learning. Introduction to Transfer learning, Transfer Learning Process and types and Application. <b>CASE STUDY:</b> Object Detection, Recommender System, Malware Classification, Crop Yield Prediction, machine Learning in Networks.

### TEXT BOOKS

1. R for data science : Import, Tidy, Transform, Visualize, And Model Data, Hadley Wickham, O'Reilly
2. Introduction to Machine Learning, E. Alpaydin. MIT Press
3. Machine Learning, T.M. Mitchell, Mc-Graw Hill

### REFERENCE BOOKS

1. Pattern Recognition and Machine learning , C.M. Bishop, Springer Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning (ESL), Springer, 2009 (freely available online)

### OPEN EDUCATIONAL RESOURCES (OERs)

1. **NPTTEL – Data Science for Engineers (with R examples)**  
**Link:** <https://nptel.ac.in/courses/106106179>  
**Instructor:** Prof. Raghunathan Rengaswamy (IIT Madras)  
**Topics:** Data preprocessing, classification, regression, clustering using R
2. **edX – Data Analysis for Life Sciences (R-based ML Intro)**  
**Link:** <https://www.edx.org/professional-certificate/harvardx-data-analysis-for-life-sciences>  
**Institution:** Harvard University  
**Courses include:** Statistical learning, ML using R, case studies

## OPEN SOURCE SOFTWARE

Course Code: 25CSPE4031	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

### COURSE OBJECTIVE

1. To introduce concepts, principles and applications of open source software.
2. To discuss the open source software development process.
3. To understand the difference between open source software and commercial software.
4. To familiarize myself with the Linux operating system.
5. To understand and develop web applications using open source web technologies like Apache, MySql and PHP (LAMP/XAMP).

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating systems.
3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website.

### MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES (CLOS)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	√	√				
CO2		√	√			
CO3			√	√		
CO4				√	√	
CO5					√	√

**Mapped SDGs: SDG-4, SDG-9, SDG-11**

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<b>UNIT I OPEN SOURCE:</b> Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where can I use Linux? Linux Kernel – Linux Distributions.
UNIT-II	<b>UNIT II LINUX:</b> Introduction to Linux Essential Commands - Filesystem Concept - Standard Files 1. The Linux Security Model - Vi Editor - Partitions creation - Shell Introduction 2. String Processing - Investigating and Managing Processes - Network Clients - Installing Application.
UNIT-III	<b>UNIT III APACHE:</b> Apache Explained - Starting, Stopping, and Restarting Apache - Modifying the Default Configuration - Securing Apache - Set User and Group - Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with .htaccess.
UNIT-IV	<b>UNIT IV MYSQL:</b> Introduction to MYSQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.
UNIT-V	<b>UNIT V PHP:</b> Introduction- General Syntactic Characteristics - PHP Scripting - Commenting your code - Primitives, Operations and Expressions - PHP Variables - Operations and Expressions Control Statement - Array - Functions - Basic Form Processing - File and Folder Access - Cookies - Sessions - Database Access with PHP - MySQL - MySQL Functions - Inserting Records - Selecting Records - Deleting Records - Update Records.

### TEXT BOOK

- James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", Dorling Kindersley (India) Pvt. Ltd, 2008.

### REFERENCE BOOK

- Eric Rosebrock, Eric Filson, "Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.
- Philosophy of GNU URL: <http://www.gnu.org/philosophy/>.
- Version control system, URL: <http://git-scm.com/>
- SVN version control, URL: <http://svnbook.red-bean.com>

### OPEN EDUCATIONAL RESOURCES (OERs)

**1. NPTEL – Data Science for Engineers (with R examples)**

**Link:** <https://nptel.ac.in/courses/106106179>

**2. edX – Data Analysis for Life Sciences (R-based ML Intro)**

**Link:**

<https://www.edx.org/professional-certificate/harvardx-data-analysis-for-life-sciences>

### NASSCOM ASSOCIATE ANALYTICS - III

Course Code: 25CSPE4039	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVE

1. This course provides knowledge of the advanced concepts of tools, technologies & programming languages which is used in day to day business analytics cycle.

#### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand the tools, technologies & programming languages which are used in the day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

**Mapped SDGs: SDG-4, SDG-8, SDG-9**

#### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
<b>UNIT-I</b>	<b>Introduction to Predictive Analytics &amp; Linear Regression (NOS 2101)</b> What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc. Need for Business Modelling, Regression – Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc.
<b>UNIT-II</b>	<b>Logistic Regression Objective Segmentation (NOS 2101)-</b> Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and complexity, Multiple Decision Trees etc.
<b>UNIT-III</b>	<b>Time Series Methods/Forecasting, Feature Extraction (NOS 2101)</b> Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average, Energy etc and Analyze for prediction.
<b>UNIT-IV</b>	<b>Working with Documents (NOS 0703)</b> Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents – case studies, articles, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparation tools – Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.
<b>UNIT-V</b>	<b>Develop Knowledge, Skill and Competences (NOS 9005)</b>

	Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.
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<b>TEXT/REFERENCE BOOKS</b>
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NASSCOMM
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### ADVANCED INTERNET OF THINGS

Course Code: 25CSPE4041	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVES

1. To provide an in-depth understanding of advanced IoT concepts, architectures, and protocols, emphasizing the integration and interoperability of various IoT components.
2. To delve into the design and implementation of IoT sensor networks and the methods for collecting, processing, and analyzing IoT data.
3. To provide comprehensive knowledge of the security and privacy challenges in IoT, and the strategies to mitigate these challenges.
4. To explore various advanced IoT applications across different industries and analyze real-world case studies to understand the practical implementation of IoT solutions.
5. To investigate the emerging trends and future directions in IoT, including advancements in technologies, standards, and applications.

#### COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand advanced concepts and principles of IoT
2. Design and implement IoT sensor networks.
3. Identify and analyze various IoT security threats and vulnerabilities and Implement security protocols and techniques to protect IoT systems.
4. Identify advanced IoT applications in different industries and analyse the real-world case studies of IoT implementations.
5. Evaluate the impact of emerging IoT technologies on various industries and develop a project that should demonstrate proficiency in IoT architecture, sensor networks, data analytics, security, and application development.

#### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOME (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

**Mapped SDGs: SDG-2, SDG-3, SDG-9, SDG-11**

## COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	<b>Advanced IoT Concepts and Architectures</b> Overview of IoT and its evolution, Advanced IoT architectures and their components, IoT communication protocols (MQTT, CoAP, AMQP, etc.), IoT standards and frameworks, Interoperability challenges and solutions in IoT
UNIT-II	<b>IoT Sensor Networks and Data Analytics</b> Design and deployment of IoT sensor networks, Sensor data acquisition and preprocessing techniques, IoT data storage solutions, Data analytics and machine learning for IoT, Performance and scalability in IoT data analytics
UNIT-III	<b>IoT Security and Privacy</b> Security challenges in IoT, Common IoT security threats and vulnerabilities, IoT security protocols and best practices, Privacy concerns and data protection in IoT, Legal and regulatory considerations in IoT security
UNIT-IV	<b>IoT Applications and Case Studies</b> Advanced IoT applications in healthcare, agriculture, smart cities, etc., Case studies of successful IoT implementations, Challenges in IoT application deployment, Impact of IoT on business processes, Planning and managing IoT projects
UNIT-V	<b>Emerging Trends and Future Directions in IoT</b> Emerging IoT technologies and standards, Future directions in IoT research and development, Impact of emerging IoT technologies on different sectors, Research opportunities in IoT, Strategic planning for future IoT advancements

### TEXT BOOKS

IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Rob Barton Released June 2017  
Publisher(s): Cisco Press ISBN: 9780134307091

Enterprise Internet of Things Handbook by Arvind Ravulavaru Released April 2018  
Publisher(s): Packt Publishing ISBN: 9781788838399

Analytics for the Internet of Things (IoT) by Andrew Minter Released July 2017  
Publisher(s): Packt Publishing ISBN: 9781787120730

### REFERENCE BOOKS

Analytics: Data Science, Data Analysis and Predictive Analytics for Business” by Daniel Covington.

Artificial Intelligence for IoT: “IBM Reference Architecture for High Performance Data and AI in Healthcare and Life Sciences” by Dino Quintero, Frank N. Lee.

## OPEN EDUCATIONAL RESOURCES (OERs)

### 1. NPTEL – IoT: Communication Protocols

**Link:** <https://nptel.ac.in/courses/106105195>

**Instructor:** Prof. Prabhakar T.V. (IISc Bangalore)

**Topics:** MQTT, CoAP, 6LoWPAN, ZigBee, BLE, Protocol stack for IoT

### 2. NPTEL – Sensor Networks and IoT

**Link:** <https://nptel.ac.in/courses/106105173>

**Instructor:** Prof. Prabhakar T.V.

**Topics:** WSN integration with IoT, edge computing, embedded systems

### 3. edX – Embedded Systems and IoT (Advanced Level)

**Link:** <https://www.edx.org/professional-certificate/harvardx-tinyml>

**Focus:** TinyML (Machine Learning on edge IoT devices)

**Topics:** Edge AI, low-power devices, sensor data classification

### ADVANCED BLOCKCHAIN

Course Code: 25CSPE4047	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 1 0	
Credits: 4	

#### COURSE OBJECTIVE

1. To understand Blockchain technology and the key concepts like cryptography and cryptocurrency concepts.
2. To gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners
3. To interpret the prospects of Blockchain and assess how Blockchain can improve your business standards.
4. To deploy your private Blockchain on the web where you can visually see your chains & send transactions between nodes
5. To infer Hyperledger project, its architecture, APIs and network topology

#### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.
2. Understand how blockchain solutions are transforming the industry landscape.
3. Design and develop for a permissioned blockchain
4. Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.
5. Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

#### MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

Mapped SDGs: SDG-8, SDG-9, SDG-16

#### COURSE CONTENTS

UNIT NUMBER	CONTENTS

<b>UNIT-I</b>	<b>Blockchain prerequisites and Introduction to Blockchain</b> Introduction to HTML 5 and Javascript Programming, Concept of callback, promises and Async/Await, NodeJS- Server side Javascript, Docker essentials, Containers Orchestration, Implementations, Creating and Deploying Docker containers, Introduction to Blockchain
<b>UNIT-II</b>	<b>Blockchain in detail and Blockchain Status</b> Understand the business context behind blockchain and the problems that blockchain aims to solve, Distinguish between blockchain for business and other blockchain implementations, Enumerate the broad categories of blockchain solutions, Understand the state of the blockchain industry in 2019, in terms of technologies, topics and communities, See how today's blockchain implementations vary, Look at the indicators that point to blockchain's future
<b>UNIT-III</b>	<b>Linux Foundation Hyperledger and Blockchain Use-Cases</b> Understand the background behind the Linux Foundation Hyperledger project, Enumerate and compare the different Hyperledger projects, Introduce Hyperledger Fabric, Learn about some successful blockchain projects, Evaluate good vs. bad blockchain ideas, Assess business value
<b>UNIT-IV</b>	<b>Blockchain Developer part 1:-</b> Block chain principles and its use in the enterprise, Blockchain infrastructure and applications, Identify participants, assets, transactions in a business network, Hyperledger Fabric, Blockchain solution architecture, Peers, smart contracts, channels, world state
<b>UNIT-V</b>	<b>Blockchain Developer part 2:-</b> Consensus, ordering service and transaction endorsement, Chaincode structure, lifecycle and deployment approaches., Blockchain deployment with Docker and Kubernetes, Blockchain security on Hyperledger Fabric
<b>UNIT-VI</b>	<b>PROJECT</b> Research Activities on Blockchain network

<b>REFERENCES</b>
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IBM Skill Set
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**SYLLABUS OF ABILITY ENHANCEMENT COURSES  
COMMUNICATIVE ENGLISH  
(COMMON TO ALL BRANCHES OF B.TECH.)**

<b>Communicative English (Common To All branches of B.Tech)</b>	
<b>Credits: 2</b>	<b>Continuous Evaluation:40 Marks</b>
<b>L T P: 2 0 0</b>	<b>End Semester Examination:60 Marks</b>
<b>Prerequisite: Nil</b>	<b>Course Code:23AEC101</b>

**COURSE OBJECTIVES (CO)**

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication
2. To empower the students to improve both abilities to communicate and their linguistic competence and boost their confidence.
3. To enable the students to properly communicate and express themselves in writing.
4. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.
5. To study, understand and implement each unit according to National Education Policy 2020 and Bloom's Taxonomy.

**COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Recall and identify English vocabulary words and grammatical structures.
2. Analyse the structure and organization of written texts, identifying the introduction, body, and conclusion.
3. Examine how the use of specific language techniques impacts the effectiveness of communication.
4. Assess and critique public speeches and presentations based on clarity, coherence, and persuasiveness.
5. Evaluate one's own language skills and identify areas for improvement.

**MAPPING MATRIX OF COURSE OBJECTIVES (CO) & COURSE LEARNING**

Course Objective	Course Learning Outcomes				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓	✓	✓		
CO 2		✓		✓	
CO 3					
CO 4				✓	✓
CO 5					✓

**COURSE CONTENTS**

**Unit-I: Introduction to Communication**

- The importance of communication through English at the present time; the process of communication and factors that influence communication: sender, receiver, channel, code, topic, message, context, feedback, 'noise', filters and barriers;
- Verbal and non-verbal communication
- Listening Skills: Importance and types of Listening

- Identifying and rectifying common errors: Subject-verb agreement, Concord, Types of Sentences (Statements, interrogative, exclamatory and imperative, wh- questions, question-tags)
- Use of modals
- Vocabulary Building, word collocation

#### **Unit-II: Workplace Communication**

- Communication challenges in culturally diverse workforce; Ethics in Communication
- Bias-free communication
- Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; Power Point Presentation

#### **Unit-III: Writing at Work**

- Business letters
- Writing notices, circulars, emails.
- Writing reports and precis writing
- Writing CVs (for Technical Positions and Internships)

#### **Unit-IV: Soft Skills/Life Skills**

- Body Language
- Connected Speech (Intonation in Everyday Speaking and Conversation)
- Types of interviews, Planning and preparing for a Job Interview; Stages of an Interview; Mastering the art of giving interviews.

#### **TEXT BOOKS**

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [MACMILLAN]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

#### **REFERENCE BOOKS**

1. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
2. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press. 2nd Edition.
3. Business Communication Today by Courtland L Bovee and Thill, Pearson

**SYLLABUS OF SKILL ENHANCEMENT COURSES  
SEMESTER – III**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>2 / 3</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS351</b>	<b>Course Title</b>	<b>Effective Communication Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

- TO1. To define and understand communication and its process.
- TO2. To make student practice on communication skills via LSRW approach via instructing, assessing and re engaging, engaging,
- TO3. To enhance the confidence and motivation of a student by honing his communication skills.

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO)	TLO1	TLO2	TLO3
TRAINING OBJECTIVES (TO)			
TO1	√		
TO2	√	√	
TO3		√	√

Unit	Course Contents	Student Engagement Activity
<b>Unit-I</b>	<b>Verbal Communication Skills</b> <ul style="list-style-type: none"> <li>● Communication Process &amp; its importance</li> <li>● 7 C's of Communication</li> <li>● Formal &amp; Informal Conversation</li> <li>● Requirements of effective verbal communication</li> </ul>	Conversation Cards Activity
<b>Unit-II</b>	<b>Nonverbal Communication Skills</b> <ul style="list-style-type: none"> <li>● Importance of nonverbal skills in effective communication</li> <li>● Types of nonverbal (body language) skills</li> <li>● Barriers to nonverbal communication</li> </ul>	Power of Body Language Activity
<b>Unit-III</b>	<b>Listening Skills</b> <ul style="list-style-type: none"> <li>● Role of listening skills in effective communication</li> <li>● Barriers to listening</li> <li>● Overcoming listening barriers</li> <li>● Empathetic listening &amp; avoiding selective listening</li> </ul>	Chinese Whisper Activity
<b>Unit-IV</b>	<b>Reading &amp; Writing Skills</b> <ul style="list-style-type: none"> <li>● Types of reading strategies to enhance improve reading skills</li> <li>● Types of written communication</li> </ul>	The What IF Activity

<b>Unit- V</b>	<b>Visual Communication</b> <ul style="list-style-type: none"> <li>● Types of visual communication</li> <li>● Importance of visual communication</li> <li>● Picture narration/description technique</li> </ul>	Interpret The Picture Activity
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<b>Learning Resources</b>	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.

### Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Effective Communication Skills Course

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Verbal Communication Skills	Speech Activity	15	Written Test	10
II	Non Verbal Communication Skills	Role Play	15		
III	Listening Skills	Oral Assessment / Written Assessment	10		
IV	Reading & Writing Skills		20	Viva	20
V	Visual Communication		10		

<b>DIGITAL MARKETING</b>	
Course Code: 25CS0201C	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination: 30 Marks
L T P : 0 0 2	
Credits: 2	

<b>TRAINING OBJECTIVES(TOs)</b>
<ol style="list-style-type: none"> <li>1. To provide a foundational understanding of digital marketing concepts and strategies.</li> <li>2. To explain the principles and practices of Search Engine Optimization (SEO).</li> <li>3. To explore the role and strategies of social media marketing.</li> <li>4. To examine digital advertising tools and methods for optimizing ad performance.</li> <li>5. To design marketing strategy.</li> </ol>

<b>TRAINING LEARNING OUTCOMES (TLO's)</b>
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:</p> <ol style="list-style-type: none"> <li>6. Explain the importance and components of digital marketing.</li> <li>7. Understand how search engines work and apply SEO techniques to improve website visibility.</li> <li>8. Develop strong social media profiles and create effective social media marketing strategies.</li> <li>9. Utilize digital advertising tools and measure the performance of digital advertising campaigns.</li> <li>10. Analyze and design marketing strategy for a given application or domain.</li> </ol>

#### **TRAINING LEARNING OUTCOMES (TLOs)-TRAINING OBJECTIVES (TOs) MAPPING**

<b>CLO CO</b>	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

#### **COURSE CONTENTS**

<b>UNIT NUMBER</b>	<b>TRAINING CONTENTS</b>	<b>ACTIVITY</b>
<b>UNIT-I</b>	<b>INTRODUCTION TO DIGITAL MARKETING &amp; MARKETING ANALYSIS:</b> Introduction To Online Digital Marketing, Importance Of Digital Marketing, Traditional Vs. Digital Marketing, Types of Digital Marketing, Market Research, Keyword Research And Analysis	Use keyword planner tools to identify high-potential keywords for their industry.
<b>UNIT-II</b>	<b>SEARCH ENGINE OPTIMIZATION(SEO):</b> Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, , Types Of SEO technique, Keywords, Keyword Planner tools	<b>Review the SEO history and current status of a real-world website</b>

<b>UNIT-III</b>	<b>SOCIAL MEDIA MARKETING:</b> Introduction to Social Media Networks, Types of Social Media Websites and their Marketing strategies. Creating Strong Social Media Profiles.	<b>Develop a social media strategy for a startup, focusing on creating strong profiles and engaging content.</b>
<b>UNIT-IV</b>	<b>ADVERTISING TOOLS and OPTIMIZATION:</b> Advertising & its importance, Digital Advertising, Different Digital Advertisement, Performance of Digital Advertising, Display Advertising Media, Digital metrics.	Analyze the digital advertising strategy of a major e-commerce platform
<b>UNIT-V</b>	<b>CASE STUDY/HANDS-ON:</b> Googlebot (Google Crawler) /You-tube advertising/ Develop a social media strategy for a startup, focusing on creating strong profiles and engaging content/ Design a digital advertising campaign for a local business and measure its performance using digital metrics.	

<b>TEXT BOOKS</b>
<ul style="list-style-type: none"> <li>• Digital Marketing –Kamat and Kamat-Himalaya</li> <li>• Marketing Strategies for Engaging the Digital Generation, D. Ryan</li> </ul>
<b>REFERENCE BOOKS</b>
<ul style="list-style-type: none"> <li>• Digital Marketing, V. Ahuja, Oxford University Press</li> <li>• Digital Marketing, S.Gupta, McGraw-Hill</li> <li>• Quick win Digital Marketing, H. Annmarie , A. Joanna, Paperback edition</li> </ul>

**SEMESTER -IV**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	2 / 4	<b>Course Category</b>	SEC
<b>Course Code</b>	23SS452	<b>Course Title</b>	<b>Teamwork &amp; Interpersonal Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
2. To equip the students with capability of handling stress and utilization of work time effectively.
3. To make the students understand the importance and application of Emotional Quotient, Critical Thinking & Problem Solving Skills.

**Training Learning Outcomes (TLO): -****After the completion of the training, the student will have ability:**

1. To be confident working in a team and leading it as well.
2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>				
<b>Training Learning Outcomes (TLO) Training Objectives(TO)</b>	TLO1	TLO2	TLO3	TLO4
T01	√			
T02		√		
T03			√	√

<b>Unit</b>	<b>Course Contents</b>	<b>Student Engagement Activity</b>
<b>Unit - I</b>	<b>Team Management</b> <ul style="list-style-type: none"> <li>● Team communication &amp; team conflict resolution</li> <li>● Role of a team leader</li> <li>● Team goal setting &amp; understanding team development</li> <li>● Team dynamics &amp; multicultural team activity</li> <li>● Johari Window Model</li> </ul>	Collaborative Working Game Activity

<b>Unit-II</b>	<b>Time Management</b> <ul style="list-style-type: none"> <li>• Time management matrix</li> <li>• Pareto Principle (80/20 rule)</li> <li>• Development process of plan of action</li> </ul>	What You Did Yesterday Activity
<b>Unit-III</b>	<b>Leadership</b> <ul style="list-style-type: none"> <li>• Difference between leadership &amp; management</li> <li>• Types of leadership style</li> <li>• Core leadership skills</li> </ul>	Lead The Blindfolded Activity
<b>Unit-IV</b>	<b>Stress Management</b> <ul style="list-style-type: none"> <li>• Sign of stress &amp; its impact</li> <li>• Types of stress</li> <li>• Techniques of handling stress</li> </ul>	Keeping Cool Activity
<b>Unit - V</b>	<b>Emotional Intelligence</b> <ul style="list-style-type: none"> <li>• Emotional intelligence &amp; emotional competence</li> <li>• Components &amp; behavioral skills of emotional intelligence</li> </ul>	Guess The Emotion Game Activity
<b>Unit - VI</b>	<b>Critical Thinking</b> <ul style="list-style-type: none"> <li>• Types of thinking &amp; Characteristics</li> <li>• Critical thinking standards</li> <li>• Barriers to critical thinking</li> </ul>	Think Pair Share Activity

<b>Learning Resources</b>	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

### **Pedagogy**

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### **Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Teamwork & Interpersonal Skills**

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Team Management	Role Play / Group Activity	10	Written Test	10
II	Time Management		10		
III	Leadership		10		
IV	Stress Management	Assignment	10	Viva	20
V	Emotional Intelligence	Written Test	10		
VI	Critical Thinking		20		

DESIGN THINKING AND AUGMENTED VIRTUAL REALITY	
Course Code: 25CS0202B	Continuous Evaluation: 70 Marks
Prerequisite: NIL	End Semester Examination:30 Marks
L T P : 0 0 2	
Credits: 1	

TRAINING OBJECTIVES (CO)
1. To recognize the importance of DT.
2. To explain the phases in the DT process.
3. To familiarize the students with the Augmented Virtual Reality Environment.
4. To establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable field of Computer Science

TRAINING LEARNING OUTCOMES (TLOS)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of training the students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and analyze design thinking history and its various concepts.
3. Understand, analyze and create models with user collaboration to apply design thinking concepts.
4. Understand the role and importance of graphics in VR, AR and MR.
5. Understand the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

#### TRAINING LEARNING OUTCOME (TLO)-TRAINING OBJECTIVE (TO) MAPPING

	TLO1	TLO2	TLO3	TLO4	TLO5
TO1	√				
TO2		√	√		
TO3				√	
TO4					√

MAPPED SDGs: SDG-3, SDG-4, SDG-9

#### TRAINING CONTENTS

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
UNIT-I	<p><b>INTRODUCTION TO DT</b>            Recognize the importance of Design Thinking, Identify the steps in the DT process, Recognize the steps in the empathize phase of DT, Identify the steps required to conduct an immersion activity.  <b>Student Activity:</b> <i>Product You Loved/Hated</i> – Reflective discussion.</p>	Product that you loved and hated activity.

<p><b>UNIT-II</b></p>	<p><b>DEFINE PHASE OF DT</b>  Conduct an immersion activity and fill up the DT question template, Recognize the steps to create personas in the define phase of DT, Recognize the steps to create problem statements in the define phase of DT, Define the problem statements in the define phase of DT  <b>Student Activity:</b> Interview people and fill the DT Question template-<i>User Interview + Template Fill-up</i></p>	<p>Interview people and fill the DT Question template</p>
<p><b>UNIT-III</b></p>	<p><b>IDEATE PHASE OF DT</b>  Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, Recognize the importance of the prototype phase in DT.  <b>Student Activity:</b> Ideate a solution for a Given problem-Rapid prototyping ,Redesign a Flawed Experience-doodling, storytelling, importance of prototyping.</p>	<p>Ideate a solution for a given problem.</p>
<p><b>UNIT-IV</b></p>	<p><b>INTRODUCTION TO VR and AR</b>  Historical Overview, Current Trends and Future applications of Immersive Technologies, Best practices in VR, AR and Mixed Reality (MR), Categorization of VR and AR techniques, Input and Output devices used in AR and VR. Case Study : Google Lens, ARCore  <b>Student Activity:</b>Case studies: Google Lens, ARCore, Explore and compare AR/VR apps.</p>	<p>To study various AR and VR based existing applications.</p>
<p><b>UNIT-V</b></p>	<p><b>HANDS ON ACTIVITY</b>  This activity will help the students to identify the importance of an innovative approach : a) Discuss about a product that you like or dislike and identify what they need in a bad product to make it good. b) Design a prototype of how AR and VR can be used in Education.  <b>Student Activity:</b>Designing of Solution to the Problem.Test and refine prototype, Team project with prototype demo</p>	<p>Designing of Solution to the Problem.</p>

**Text and Reference Books:**

1. Hooked – Nir Eyal
2. The Art of Creative Thinking – Rod Judkins
3. Start With Why – Simon Sinek
4. Start-Up Nation – Dan Senor and Saul Singer
5. Handbook of Virtual Environments – Kelly S. Hale, Kay M. Stanney
6. Real Virtuality: A Code of Ethical Conduct – Michael Madary & Thomas K. Metzinger
7. The VR Book: Human-Centered Design for Virtual Reality – Jason Jerald

**Open Educational Resources (OERs):**

1. XR-Ed Framework (2020) – Design guidelines for educational XR environments  
Wikipedia+2Formosa Publisher+2Scribd+2dl.gi.de+3arXiv+3IRRODL+3
2. Open XR for Education Framework – Usable for curriculum unit planning  
WIRED+8ERIC+8IRRODL+8
3. FrontiersEdu (2024) – AR/STEAM study with OER emphasis Frontiers+1Medium+1

4. Scribd Student Handbook Level-2 AR/VR – Interactive design-thinking prompts

**Key Journal Articles**

1. “Design Thinking Testing of AR/VR Application for Bali’s Lontar Prasi Preservation” – 2022 Formosa Publisher Demonstrates DT phases applied to AR/VR cultural app.
2. Frontiers in Virtual Reality (2023) – Design-thinking skill enhancement in VR Frontiers A thorough literature survey of VR enhancing DT abilities.
3. Journal of Physical Prototyping (Taylor & Francis) – Ongoing journal on VR rapid prototyping (OA, IF 10.2) Frontiers+1Frontiers+1Wikipedia
4. IEEE TVCG – Monthly journal on VR/AR visualization and UX methods
5. Kelly S. Hale (Editor), Kay M. Stanney (Editor). 2014. Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition (Human Factors and Ergonomics) ISBN-13: 978-1466511842
6. Michael Madary and Thomas K. Metzinger. 2016. Real Virtuality: A Code of Ethical Conduct.Recommendations for Good Scientific Practice and the Consumers of VR-Technology. Frontiers in Robotics and AI 3, February: 1–23. <http://doi.org/10.3389/frobt.2016.00003>
7. Jason Jerald. 2015. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool Publishers. <http://doi.org/10.1145/2792790>

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code: 25CS0202</b>	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
L T P : 0 0 2	
Credits: 1	

### TRAINING OBJECTIVES

5. To understand the need of AI
6. To describe basic AI algorithms (e.g., standard search algorithms).
7. To learn about one of the learning method of AI that is Machine Learning.
8. To identify potential application domains of AI and machine learning in practice.

### TRAINING LEARNING OUTCOMES (TLOS): -

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of training the students will be able to:

5. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
6. Understands the basics and need of AI and Machine learning in global view.
7. Understands, apply and evaluate the supervised learning techniques.
8. Design and implement the different applications using the concepts of AI and ML

### TRAINING LEARNING OUTCOME (TLO)-TRAINING OBJECTIVE (TO) MAPPING

	TLO1	TLO2	TLO3	TLO4
<b>TO1</b>	√			
<b>TO2</b>		√		
<b>TO3</b>		√	√	
<b>CO4</b>			√	√

**MAPPED SDGs: SDG-3, SDG-4, SDG-9**

### TRAINING CONTENTS

MODULE	TRAINING CONTENTS	STUDENTS ENGAGEMENT ACTIVITY
<b>I</b>	<b>INTRODUCTION:</b> Introduction to AI: Definitions, Historical foundations, Basic Elements of AI, Characteristics of intelligent algorithm, AI application Area.	Classification of AI Problems into AI task Domains
<b>II</b>	<b>PROBLEM SOLVING:</b> Depth-first, breadth-first search, Problem Reduction, Constraint Satisfaction , Means-End Analysis.	Solving manually constraint satisfaction problem

MODULE	TRAINING CONTENTS	STUDENTS ENGAGEMENT ACTIVITY
III	<b>INTRODUCTION TO MACHINE LEARNING</b> Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques.	Identification of ML Model based on Application
IV	<b>CLASSIFICATION PROBLEM</b> Machine learning Algorithms for classification problem	Design decision trees
V	<b>HANDS ON ACTIVITY :</b> Students will apply the methods learnt to design applications for d) Constraint Satisfaction Problem e) Robot Traversal f) Classification problems like COVID Detection, Spam classification etc.	Implement the given activity.

#### Learning Resources

1. Introduction to Machine Learning, E. Alpaydin. MIT Press
2. Machine Learning, T.M. Mitchell, Mc-Graw Hill
3. Stuart Russell, Peter Norvig, Artificial intelligence : A Modern Approach, Prentice Hall, Fourth edition, 2020.
4. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill.

**SEMESTER – V**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>3 / 5</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS553</b>	<b>Course Title</b>	<b>Presentation Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO):-**

1. To develop the public speaking skills of the student.
2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
3. To make the students learn to speak in a debate session by putting his arguments and making others accept his viewpoint convincingly.

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

1. To be confident in presenting himself in front of an audience.
2. To become professional in his approach towards work culture.
3. To enhance the level of communication skills while interacting with others.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>			
<b>TLOs/TOs</b>	<b>TLO1</b>	<b>TLO2</b>	<b>TLO3</b>
T01	√	√	
T02		√	
T03		√	√

<b>Unit</b>	<b>Course Contents</b>	<b>Student Engagement Activity</b>
<b>Unit-I</b>	<b>Importance of Presentation Skills</b> <ul style="list-style-type: none"> <li>● 4 P's of presentation skills – plan, prepare, practice &amp; present</li> <li>● Guidelines for effective presentation</li> </ul>	PPT Presentation Activity
<b>Unit-II</b>	<b>Storytelling Skills</b> <ul style="list-style-type: none"> <li>● 4 P's of storytelling skills – people, place, plot &amp; purpose</li> <li>● Types of storytelling techniques</li> <li>● Importance of storytelling skills</li> </ul>	Start From Where I Stopped Activity

<b>Unit-III</b>	<b>Corporate Culture Etiquettes</b> <ul style="list-style-type: none"> <li>● Importance of professional behavior at work place</li> <li>● Understand &amp; implementation of etiquettes at work place</li> <li>● Importance of values &amp; ethics</li> <li>● Types of professional / corporate etiquettes</li> </ul>	Etiquettes Role Play Activity
<b>Unit-IV</b>	<b>Debate / Extempore</b> <ul style="list-style-type: none"> <li>● Difference between debate, extempore &amp; group discussion</li> <li>● Learning argument /counter argument in debate</li> </ul>	Current Affair Topic Speech Activity
<b>Unit-V</b>	<b>Art of Creating Impression</b> <ul style="list-style-type: none"> <li>● Importance of creating first impression</li> <li>● 6 ways to master the art of creating impression</li> </ul>	Speech Activity
<b>Unit-VI</b>	<b>Problem Solving</b> <ul style="list-style-type: none"> <li>● Types of problems &amp; its solutions</li> </ul> Problem solving process & tools	Think Pair Share Activity

<b>Learning Resources</b>	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

#### **Pedagogy**

1. The training will be based on the concept of learning by practice.
2. The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student engagement in training activities.
3. The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

#### **Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Presentation Skills**

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Importance of Presentation Skills	Presentation Activity	20	Written Test	10
II	Storytelling Skills	Speech Activity	15		
III	Corporate Culture Etiquettes	Assignment	10		
IV	Debate/Extempore	Speech Activity / Written Activity	15	Viva	20
V	Art of Creating Impression		10		
VI	Problem Solving				

### WEARABLE Technology

Course Code: 25CS0301A	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P :0 0 2	
Credits: 1	

#### COURSE OBJECTIVES (CO's)

1. To know the hardware requirement of wearable systems
2. To understand the communication and security aspects in the wearable devices
3. To know the applications of wearable devices in the field of medicine.

#### COURSE LEARNING OUTCOMES (CLO's)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Describe the concepts of wearable systems.
2. Explain the energy harvestings in wearable devices.
3. Use the concepts of BAN in health care.
4. Compare the various wearable devices in healthcare system

#### COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO) MAPPING

CLO CO	CLO1	CLO2	CLO3	CLO4
CO1	√	√		
CO2		√	√	
CO3			√	√

#### COURSE CONTENTS

UNIT NUMBER	TRAINING CONTENTS
UNIT-I	<p><b>INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS</b>                      Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Impedance plethysmography, Wearable ground reaction force sensor.</p>
UNIT-II	<p><b>SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES</b>                      Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell,</p>

	Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.
<b>UNIT-III</b>	<b>WIRELESS HEALTH SYSTEMS</b> Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.
<b>UNIT-IV</b>	<b>APPLICATIONS OF WEARABLE SYSTEMS</b> Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

<b>TEXT BOOKS</b>
<ul style="list-style-type: none"> <li>● Annalisa Bonfiglio and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011</li> <li>● Zhang and Yuan-Ting, Wearable Medical Sensors and Systems, Springer, 2013</li> <li>● Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014</li> <li>● Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications, Pan Stanford Publishing Pte.Ltd, Singapore, 2012</li> </ul>
<b>REFERENCE BOOKS / RESOURCES</b>
<ul style="list-style-type: none"> <li>● Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.</li> <li>● Guang-Zhong Yang, Body Sensor Networks, Springer, 2006.</li> </ul>

**SEMESTER - VI**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Faculty of Engineering &amp; Technology</b>			
<b>Programme</b>			
<b>Year / Semester</b>	3 / 6	<b>Course Category</b>	SEC
<b>Course Code</b>	23SS654	<b>Course Title</b>	Professional Skills
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

1. To encourage students to learn and apply effective writing skills.
2. To make the students learn various types of business correspondence letters, cover letters & resume.
3. To encourage students to learn how to talk and convince people in GD & interview.
4. To make the students learn to build rapport for building positive relationships professionally at the workplace.

**Training Learning Outcomes (TLO): -****After the completion of the training, the student will have ability:**

1. To understand the importance of professional writing required in the workplace.
2. To explore different formats in resume, cover letters & other business related letters.
3. To develop knowledge, skills and understanding people in-group and individually.
4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>				
<b>Training Learning Outcomes (TLO) Training Objectives(TO)</b>	TLO1	TLO2	TLO3	TLO4
TO1	√			
TO2	√	√		
TO3		√	√	√
TO4.			√	√

**Course Contents**

<b>Unit</b>	<b>Course Contents</b>	<b>Student Engagement Activity</b>
<b>Unit-I</b>	<b>Email Writing</b> <ul style="list-style-type: none"> <li>● Importance of email communication skills</li> <li>● Basic rules of effective email writing</li> <li>● Structure of email – address, subject, message text, attachments, signature</li> </ul>	Email Practice Activity

<b>Unit-II</b>	<b>Resume Writing</b> <ul style="list-style-type: none"> <li>● Difference between Resume, CV &amp; Bio data</li> <li>● Guidelines of resume writing</li> <li>● Resume preparation of the student</li> </ul>	Resume Making Activity
<b>Unit-III</b>	<b>Letter Writing</b> <ul style="list-style-type: none"> <li>● Types of Letter Writing – Application, Leave, etc.</li> <li>● Cover letter</li> </ul>	Letter Writing Activity
<b>Unit-IV</b>	<b>Group Discussion (GD)</b> <ul style="list-style-type: none"> <li>● Characteristics of GD &amp; subject knowledge</li> <li>● Do's &amp; Don'ts in GD</li> <li>● Strategies of GD</li> <li>● Types of GD</li> </ul>	Group Discussion Practice Activity
<b>Unit-V</b>	<b>Interview Skills</b> <ul style="list-style-type: none"> <li>● Preparation of the interview &amp; company details information</li> <li>● Do's &amp; Don'ts in interview</li> <li>● Types of Interviews</li> <li>● Strategies of interview</li> </ul>	Mock Interview Practice Activity
<b>Unit-VI</b>	<b>Negotiation Skills</b> <ul style="list-style-type: none"> <li>● Importance of negotiation skills</li> <li>● Four phases of negotiation skills</li> <li>● Barriers to negotiation &amp; overcoming it</li> <li>● Win-win negotiation</li> </ul>	Win-Win Activity

Learning Resources	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

### Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Professional Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Email Writing	Written Assignment	10	Written Test	10
II	Resume Writing		10		
III	Letter Writing		10		
IV	Group Discussion	Group Discussion Activity	15	Viva	20

V	Interview Skills	Mock Interview Activity	15		
VI	Negotiation Skills	Role Play	10		

Data Analytics Tools	
Course Code: 25CS0302D	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P :0 0 2	
Credits: 1	

COURSE OBJECTIVE
<ol style="list-style-type: none"> <li>To provide an understanding of the fundamental concepts and processes of data analytics.</li> <li>To introduce students to R and R-Studio, and teach basic data types and structures in R.</li> <li>To equip students with skills for importing, exporting, and performing exploratory data analysis (EDA) in R.</li> <li>To familiarize students with report generation tools like Google Data Studio and Tableau, focusing on creating interactive dashboards.</li> <li>To enable students to apply their knowledge through hands-on activities and case studies, enhancing their practical skills in data analytics.</li> </ol>

COURSE LEARNING OUTCOMES (CLO's)
<p>The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:</p> <ol style="list-style-type: none"> <li>Demonstrate an understanding of the basic principles and processes of data analytics.</li> <li>Utilize R and R-Studio to handle basic data types and structures, and perform fundamental operations.</li> <li>Import, export, and clean data in R, and conduct exploratory data analysis (EDA) using descriptive statistics and data visualization techniques.</li> <li>Create interactive reports and dashboards using Google Data Studio and Tableau, effectively visualizing data insights.</li> <li>Apply data analytics tools and techniques to real-world datasets through hands-on projects, presenting and interpreting their findings accurately.</li> </ol>

#### COURSE LEARNING OUTCOME (CLO)-COURSE OBJECTIVE (CO) MAPPING

CLO CO	CLO1	CLO2	CLO3	CLO4	CLO5
C01	√				
C02		√			
C03			√		
C04				√	
C05					√

MAPPED SDGs: SDG-4, SDG-9

#### COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	<p><b>Introduction to Data Analytics</b>            Overview of Data Analytics: Definition and importance, Types of data analytics, Applications and examples; Data Analytics Process: Steps in the data analytics process, Key concepts; Introduction to Data Analytics Tools: Overview of tools, Comparison of tools</p>
UNIT-II	<p><b>Foundations of R and Data Structures</b>            Introduction to R and RStudio: Installation and setup, RStudio interface; Basic R Syntax and Operations: Writing and executing R commands, Basic arithmetic and logical operations, Understanding variables and assignments; Data Types and Structures in R: Vectors, matrices, and arrays, Data frames and lists, Factors and strings</p>
UNIT-III	<p><b>Data Handling and Exploratory Analysis in R</b>            File Import and Export in R: Reading data from CSV, Excel, Writing data to CSV and Excel, Handling different file types; Exploratory Data Analysis (EDA) with R: Descriptive statistics, Data visualization using `ggplot2`, Data manipulation using `dplyr`, Case study</p>
UNIT-IV	<p><b>Interactive Data Visualization Tools : Google Data Studio / Tableau / Any other</b>            Introduction, Creating an account/installation, Connecting to data sources, Building basic visualizations, Creating interactive dashboards;</p>
UNIT-V	<p><b>Hands-On Activity / Case Study</b>            Mini Project with R: Choose a dataset, Perform data manipulation, visualization, and analysis, Present findings;            Mini Project with Google Data Studio / Tableau: Choose a dataset, Create visualizations and dashboard, Present the dashboard and insights</p>

#### TEXT BOOKS

Grolemund, G., & Wickham, H. (2017). R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media.

Matloff, N. (2011). The Art of R Programming: A Tour of Statistical Software Design. No Starch Press.

Murray, D. (2016). Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software. John Wiley & Sons.

Devey, B. (2020). Google Data Studio for Beginners: A Step by Step Guide to Building Better Data Visualizations and Business Intelligence with Google Data Studio. Independently Published

#### REFERENCE BOOKS / RESOURCES

1. Shmueli, G., Patel, N. R., & Bruce, P. C. (2010). Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner. John Wiley & Sons.
2. Adler, J. (2010). R in a Nutshell: A Desktop Quick Reference. O'Reilly Media.
3. Few, S. (2013). Information Dashboard Design: Displaying Data for At-a-Glance Monitoring. Analytics Press.
4. Google. (n.d.). Google Data Studio Help Center. Retrieved from <https://support.google.com/datastudio/answer/6283323?hl=en>
5. Google. (n.d.). Introduction to Data Studio. Coursera. Retrieved from

<https://www.coursera.org/learn/google-data-studio>

**SEMESTER - VII**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	4 / 7	<b>Course Category</b>	SEC
<b>Course Code</b>	23AR755	<b>Course Title</b>	<b>Aptitude &amp; Reasoning</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make students practice on the concepts of quantitative ability and logical reasoning.
- TO3. To prepare the students for aptitude and reasoning round in placement selection process & other competitive exams.

**Training Learning Outcomes (TLO): -****After the completion of the training, the student will have ability:**

- TLO1. To understand the basic concepts of quantitative ability.
- TLO2. To solve campus placements aptitude papers covering Quantitative Ability.
- TLO3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO)	TLO1	TLO2	TLO3
TRAINING OBJECTIVES (TO)			
TO1	√		
TO2		√	
TO3			√

**A-Quantitative Ability****UNIT - I**

- Number System
- Percentage
- Profit, Loss and Discount
- Simple Interest and Compound Interest

**UNIT - II**

- Allegation and Mixture
- Average
- Ratio, Proportion and Variation, Problem on Ages and Numbers
- Time and Work
- Time, Speed and Distance

**UNIT - III**

- Permutation and Combination
- Probability
- Data Interpretation
- Geometry and Mensurations
- Sequence, Series & Progression and Logarithmic

## B- Logical Reasoning

### UNIT - IV

- Number Series and Alphabet Series
- Direction Sense Test
- Coding -Decoding
- Blood Relation

### UNIT - V

- Syllogism
- Dice, Cube and Cuboids
- Seating Arrangement

### UNIT - VI

- Clock and Calendar
- Critical Reasoning
- Order and Ranking, Ven diagram, Analogy

Learning Resources	
Text Books	<i>Quantitative Aptitude for Competitive Examinations</i> by R S Aggarwal: S Chand Publishing, 2022.
	<i>A Modern Approach to Logical Reasoning</i> by R S Aggarwal: S Chand Publishing, 2022.

### Pedagogy-

- The training will be based on the concept of learning by doing and practice.
- The training will involve 50% of the training time on teaching the concepts and the remaining 50% will be focusing on practice.
- The training will follow a circular approach where students are taught, evaluated and given feedback.

### Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Aptitude & Reasoning

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Quantitative Ability	Written Assignment	10	Written Test	30
II			10		
III			10		
IV	15				
V	15				
VI	10				

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT</b>	
<b>Course Code: 25CS0401D</b>	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 0 0 2	
Credits: 1	

### TRAINING OBJECTIVES

1. To familiarise the students with functional/operational aspects of cryptocurrency ECOSYSTEM.
2. To understand emerging abstract models for Blockchain Technology.
3. To learn various protocols of IoT.

### TRAINING LEARNING OUTCOMES (TLOS)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of training the students will be able to:

1. Understand how bitcoin and other coins work in the real world.
2. Analyse the properties of Block Chain models.
3. Understand the vision of IoT and communication protocols from a global context.
4. Design portable IoT using appropriate boards.

### TRAINING LEARNING OUTCOME (TLO)-TRAINING OBJECTIVE (TO) MAPPING

	TLO1	TLO2	TLO3	TLO4
T01	√			
T02		√		
T03			√	√

**MAPPED SDGs:- SDG-4, SDG-9, SDG-11, SDG-13**

### TRAINING CONTENTS

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
<b>I</b>	<b>CONSENSUS</b> The consensus problem, Abstract Models for BLOCKCHAIN : GARAY model, RLA Model, liveness and fairness, Proof of Stake ( PoS) based Chains, Hybrid models ( PoW + PoS)	Perform Mapping of coins and Blockchain Models
<b>II</b>	<b>BITCOIN</b> Bitcoin Introduction, Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.	To identify the type of wallet used in a specific application.
<b>III</b>	<b>Introduction to IoT:</b> Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensing: Sensors and Transducers, Sensor Classes, Sensor Types, Actuation: Actuator Basics, Actuator Types.	To identify the types and characteristics of Sensors

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
	<b>Connectivity Technologies:</b> ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, ISA100.11a.	
IV	<b>Introduction to Arduino:</b> Basic Concepts of Arduino Platform, Examples of Arduino Programming, Integration of Sensors and Actuators with Arduino,	To design a simple application of LED lightning
V	<b>HANDS ON ACTIVITY</b> The students will design an application for a smart irrigation system, smart healthcare system. In this activity students will identify the major components required for building a smart application and design the architecture and application accordingly.	Complete the Assigned Activity

#### LEARNING RESOURCES

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" -- CRC Press-2012
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
4. <https://eprint.iacr.org/2014/349.pdf>
5. <https://eprint.iacr.org/2012/718.pdf>
6. <https://github.com/ElementsProject/lightning/blob/master/doc/deployable-lightning.pdf>
7. <https://www.hyperledger.org/use/tutorials>
8. <https://docs.soliditylang.org/en/latest>
9. <https://github.com/ethereum/wiki/wiki/White-Paper>
10. <http://gavwood.com/paper.pdf>
11. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
12. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

## SYLLABUS OF MULTIDISCIPLINARY COURSES

Department of Mathematics			
Multi-Disciplinary Course (MDC)			
Year/Semester	1 <sup>st</sup> Year/1 <sup>st</sup> Semester	Course Category	Multidisciplinary Course
Course Code	25MDC101	Course Title	Statistical Methods
Continuous Evaluation: 30		End Semester Examination:70	
Prerequisite: Basic Mathematics		L T P : 2 0 2	Credits: 3

**Course Objectives (CO)** - The Course is designed with the following objectives:

1. Understand and apply various statistical measures to analyze and interpret data.
2. To analyze bivariate data using correlation and regression techniques, interpret and fit appropriate curves for predictive modeling.
3. Understand fundamental probability concepts.
4. Apply appropriate hypothesis testing methods to analyze population parameters.

**Course Learning Outcomes (CLO)** - The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Compute and interpret different measures of central tendency, dispersion to summarize and analyze datasets.
2. Compute and interpret correlation coefficients and fit a linear regression model.
3. Apply the laws of addition and multiplication, and use Bayes' theorem to solve real-world problems.
4. Elucidate and conduct hypothesis tests for single and two-population parameters in real-world scenarios.

**Mapping Matrix between Course Objectives and Course Learning Outcomes:**

CO	CLO	CL 1	CL 2	CL 3	CL 4
	CO 1	✓			
	CO 2		✓		
	CO 3			✓	
	CO 4				✓

**COURSE CONTENTS:**

UNIT	COURSE CONTENTS
UNIT-I	<p><b>Data Visualization</b></p> <p>Data types and measurement scales, Graphical representation of data, Measures of Central Tendency- mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis.</p> <p>Application domain problems: Analyze, interpretation and significance of data</p>

UNIT-II	<p><b>Bivariate Data Analysis</b>  Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's, Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination.  Application domain problems: Machine learning and data analysis</p>
UNIT-III	<p><b>Probability</b>  Probability: Introduction, random experiments, sample space, events, and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem, and its applications.  Application domain problems: Decision making, forecasting, Naives Bayes analysis</p>
UNIT-IV	<p><b>Testing of Hypothesis</b>  Type I error and Type II error and power of test. Hypothesis testing for- population means, difference of two population means, population proportions, difference between two population proportions, population variance, ratio of two population variances. Chi square test: test of goodness of fit.  Application domain problems: Decision making for the available data</p>

### TEXT BOOKS

1. Seymour Lipschutz, John Schiller, "Introduction to Probability and Statistics", Tata McGraw Hill, 2017.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, "Probability & Statistics for Engineers & Scientists", 9th Edition, Prentice Hall, 2017.

### Reference Books

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley
2. Goon A.M., Gupta M.K. and Dasgupta B. Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002
3. Fundamental of Mathematical Statistics by S.C. Gupta and V.K Kapoor, Saurabh Jain 2017
4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7<sup>th</sup> Edition R for beginners by Emmanuel Paradis (Freely available) at [https://cran.rproject.org/doc/contrib/ParadISRdebutS\\_en.pdf](https://cran.rproject.org/doc/contrib/ParadISRdebutS_en.pdf)

Department of Environmental Sciences			
Program: UG program			
Year/Semester	1 <sup>s</sup> Year/I or II	Course Category	MDC
Course Code	23MDC102	Course Title	Environmental Geoscience & Disaster Management
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

**COURSE OBJECTIVES (COs):** The Course is designed with the following objectives:

1. To provide fundamental knowledge of earth origin and earth Processes.
2. Educate the students about the types of rocks & geological resources.
3. To understand Disaster and Disaster management.
4. Role of Geospatial technology in geological resources and Disaster management.

**COURSE LEARNING OUTCOMES (CLOs)**

The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. Able to explain the origin and Internal structure of earth.
2. Analyse the Geological resources and geochemistry of minerals.
3. Collect a comprehensive understanding of disaster management.
4. Evaluate the role of technology in disaster management.

**MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)**

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)			
	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

**COURSE CONTENTS**

**Unit-1**

**Origin of the Earth:**

Theories and hypothesis of the origin of earth- Oparin-Haldane hypothesis, Big bang theory, the material basis of life, geological time scale, evolution of earth's atmosphere and life through the geological time scale.

**Unit-2**

**Internal Structure of the Earth:**

Internal Structure of Earth, differentiation of the earth into core, mantle, crust. Formation of core, mantle, crust, atmosphere, hydrosphere, and biosphere. Convection in Earth's core and production of its magnetic field. Geothermal gradient and internal heat of the Earth. Earthquake and earthquake belts: seismic waves and internal constitution of the Earth. Volcanoes and volcanism, distribution of volcanoes.

**Unit-3**

**Fundamentals of Earth process**

Concepts Rocks, Formation of rocks, types of rock (Igneous rock, Metamorphic Rocks, and Sedimentary rocks), Continental drift theory, Plate tectonic, sea floor spreading. Basic concepts of weathering, erosion, and deposition of earth materials by water, wind and glaciers.

**Unit-4**

**Geological Resources and Exploration:**

Fundamentals of geological resources, their formation, reserves in minerals, coal, oil, gas geological constraints in their availability and use; environmental consequences of their exploitation to air, water, soil, climate, and life. Distribution of minerals in India.

**Unit-5****Disaster Management:**

Disaster introduction- disaster management, capability vulnerability, risk, preparedness and mitigation. Disaster management cycle. Hazard zonation and mapping- risk reduction measures. Landslide, Earthquake, Tsunami, Flood, Minamata Disaster, Bhopal Gas Disaster, 1984, Chernobyl Disaster, 1986, Fukushima Daiichi nuclear disaster, 2011. Role of geo-spatial technology in surveillance, monitoring, risk assessment, and disaster management Sendai Framework for Disaster Risk Reduction.

**RECOMMENDED TEXTBOOKS:**

1. Mukherjee, S. (2004). Text Book of Environmental remote Sensing. Published by Macmillan India Limited New Delhi ISBN: 1403922357.
2. Keller, E.A. (1996). Introduction to Environmental Geology. Prentice Hall, Upper Saddle River, New Jersey.
3. Disaster management by R. Subramanian, Vikash Publishing house, ISBN 9352718704

**REFERENCE BOOKS**

1. Keller, E.A. (1996). Introduction to Environmental Geology. Prentice Hall, Upper Saddle River, New Jersey.
2. J.R Jensen, Remote Sensing of the Environment: An Earth Resource Perspective, 2012

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
Course Code: 24BS301	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination:60 Marks
L T P : 3 0 0	
Credits: 3	

### **COURSE OBJECTIVES**

1. To help students understand the conceptual framework of management and organizational behaviour and correlate them to manage 21st century organizations.
2. To develop understanding about management and Applicability in the corporate world.
3. To enhance and develop the skills and competencies to understand the complexities of business problems.
4. To understand, retain and recall the basics of management.
5. To make them aware about the current scenario and identify themselves in terms of adaptability.
6. To develop their skills in analysing and understanding the human behaviour in an organization.

### **COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the concept of management.
2. Learn about different management skills requirements for the corporate world.
3. Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.
4. Understand the human behaviour and its contribution at work place.
5. Understand the competitiveness in businesses.

### **COURSE CONTENT**

<b>UNIT NUMBER</b>	<b>COURSE CONTENTS</b>
<b>UNIT-I</b>	<b><i>Fundamentals of Management and Evolution of Management Thought:</i></b> Concepts of Management, Meaning of Management, Nature and Characteristics of Management, Scope of Management; Levels of Management; Approaches and contributions of Management thinkers in the field of management, Social and Ethical issues in an organisation. Understanding an organisation: Introduction, Organisational Process- Vision, Mission, Strategy, Structure, System and Job task.
<b>UNIT-II</b>	<b><i>Managerial Functions and Social Responsibility of Managers:</i></b> Planning -concept, significance, types; Planning, Organizing -concept, types of organizations, authority, responsibility, power, delegation, Centralization and Decentralization; Staffing concept and HR management; Directing; Coordinating; Control -nature, process, and techniques. The nature of CSR and Business ethics for engineers, Functional areas of management.
<b>UNIT-III</b>	<b><i>Introduction to Organisational Behaviour:</i></b> The nature and determinants of organisational behaviour, need for knowledge of OB, contributing disciplines to the field, OB Model, individual differences, Learning, Values, attitudes, Personality, Emotional Intelligence, perception and its errors.

<b>UNIT-IV</b>	<b><i>Work Motivation and Group Behaviour:</i></b> Process of motivation; Theories of motivation - need hierarchy theory, theory X and theory Y, two factor theory, Alderfer's ERG theory, Group: Types of Groups, Stages of Group Development, Group Cohesiveness, Implications of group process of organisation, Understanding Teamwork: Cross functional Teams, Designing a Team- Team Wheel.
<b>UNIT-V</b>	<b><i>Leadership, Organisation Culture, Conflict Management:</i></b> Basic Approaches (Trait Theories, Behavioural Theories & Contingency Theories) & Contemporary Issues in Leadership and Transformational leadership, Role of leader in contemporary Business, Changing Organisational culture, Change management and leading change Strategically and Conflict management.

**Reference Books:**

1. Luthans Fred (2015): Organizational Behavior, Tata McGraw Hill. (12<sup>th</sup> Edition)
2. Stephen, P Robbins (2009): Organizational Behavior, Prentice Hall of India Private Limited, New Delhi.
3. Koontz & Heinz Wehrich: Essential of Management, McGraw Hill.
4. Tripathy & Reddy: Principles of Management, Tata McGraw-Hill Publications, New Delhi
5. Principles of Management by Terry, G.R.
6. Principles of Management by Neeru Vasishth and Vibhuti Vasishth, Taxmann Publication Private Limited, New Delhi

<b>Management Process and Organizational Behaviour</b>	
Course Code: 23MDC401	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
Prerequisite: NIL	Course Category: Multidisciplinary

### **COURSE OBJECTIVES**

1. To understand the functions and responsibilities of managers.
2. To acquaint the students with the fundamentals of managing business.
3. To understand individual and group behaviour at work place so as to improve the effectiveness of an organization.
4. To analyse human behaviour in the organization setting in order to manage it in accordance to the intentions.

### **COURSE LEARNING OUTCOMES**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the roles, skills and functions of management.
2. Analyse the causes and consequences of applying different business strategies.
3. Analyse and compare individual behaviour related to motivation and rewards.
4. Identify group behaviour, leadership styles and the role of leaders in a decision making process.

### **MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES**

Course Objective s (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1	√	√		
CO 2		√		
CO 3			√	
CO 4				√

### **COURSE CONTENTS**

#### **Unit 1: Introduction to the management**

Management Concept, Nature, Process and significance, levels of management, managerial skills, functions of management, management and administration, evolution of management, Role of management and insights from Indian practices and ethos.

#### **Unit 2: Functions of the management**

Planning: Types of Plans & The planning process; Organizing: Common organisational structures; Staffing: features and necessity; Leading: types of leaders; Controlling: functions and types

#### **Unit 3: Introduction to Organizational Behaviour**

Meaning, importance and scope of OB; abilities: meaning and forms, attitudes: framework, work related attitudes, personality: types, assessment, perception: process, factors influencing perception, perceptual errors

#### **Unit 4: Foundation of Group Behaviour**

Defining and classifying groups; need to join groups, stages of group development; group dynamics: group properties as roles, norms and size; group decision making techniques, conflict management

### **TEXT BOOKS**

1. Stephen Robbins, Organizational Behavior, 16<sup>th</sup> edition (2012), Pearson Education.
2. K. Aswathappa, Organizational Behaviour, 13<sup>th</sup> edition (2016), Himalaya Publishing House.
3. Fred Luthans, Organizational Behavior, 14<sup>th</sup> edition (2017), McGraw-Hill.

**SUGGESTED READINGS**

1. Gregory Moorhead & Ricky W. Griffin, Organizational Behaviour, 11th edition (2009), Jaico Publication.
2. Tripathy PC and Reddy PN, Principles of Management, 6<sup>th</sup> edition (2011), McGraw-Hill.

<b>Year/Semester</b>	<b>3<sup>rd</sup> / 4<sup>th</sup></b>	<b>Course Category</b>	<b>MDC</b>
<b>Course Code</b>	<b>23MDC302</b>	<b>Course Title</b>	<b>Library Information Science &amp; Media Literacy</b>
<b>Continuous Evaluation: 40</b>		<b>End Semester Examination:60</b>	
<b>Prerequisite: Nil</b>		<b>L T P : 3 0 0</b>	<b>Credits: 3</b>

**Course Objectives (CO)** - The Course is designed with the following objectives:

- CO-1: To know the library collection and their classifications.
- CO-2: To discuss the library information services.
- CO-3: To understand the importance of media
- CO-4: To grasp the significance of motive of media

**Course Learning Outcomes (CLO)** - The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

- CLO-1: Explain the library collection and their classifications.
- CLO-2: Analyse the library information services.
- CLO-3: Analyse the media roles.
- CLO-4: Analyse the motive of media.

**Mapping Matrix between Course Objectives and Course Learning Outcomes:**

	<b>CO-1</b>	<b>CO-2</b>	<b>CO-3</b>	<b>CO-4</b>
<b>CLO-1</b>	√			
<b>CLO-2</b>		√		
<b>CLO-3</b>			√	
<b>CLO-4</b>				√

## **COURSE CONTENTS:**

### **UNIT-1: Library Collection**

- Type of Information Sources : Primary, Secondary and Tertiary
- Reference Collection: Type of reference sources
- Indexing and Abstracting Journals
- Multimedia Collection
- Arrangement of Information Sources : Classification

### **UNIT-2: Information Services**

- Bibliography: Type of Bibliography
- Reviews Literature
- Citation Style
- Citation Analysis: Web of Science and Scopus
- Online Databases : Structure and Retrieval

### **UNIT-3: Media Literacy**

- Introduction to Media Literacy
- Type of media: Traditional versus social media
- Bias in media

### **UNIT-4: Motive of Media**

- Media tycoons and conditions in which media works
- Research and Publication ethics

### **Recommended Books:**

1. Richard E. Rubin & Rachel G. Rubin ,Foundations of Library and Information Science, 5<sup>th</sup> Edition. ISBN-9781783304776, Facet Publication, UK
2. <https://en.unesco.org/themes/media-and-information-literacy/resources>

<b>COMPUTER-BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	
<b>Course Code:</b> 24MDC401B	<b>Internal Examination:</b> 40 Marks
<b>Credits:</b> 3	<b>External Examination:</b> 60 Marks
<b>L T P :</b> 3 0 0	
<b>Prerequisite:</b> Engineering Mathematics – III	

### **COURSE OBJECTIVES (COs)**

1. To become familiar with different operators which are useful in Numerical Analysis and introduce the concept of interpolation.
2. Familiar with numerical solutions of algebraic, transcendental and simultaneous equations. Also introduce numerical differentiation and integration with applications.
3. Familiarize yourself with numerical solutions of ordinary differential equations.
4. To equip the students with the knowledge of basic probability, Random variables, discrete as well as continuous distributions with their applications, correlation and regression.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Execute finite differences and interpolation.
2. Illustrate the numerical solution of equations and find the numerical differentiation and integration.
3. Demonstrate the numerical solutions of ordinary differential equations by different methods.
4. Solve statistical problems for real world scenarios.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

CO \ CLO	CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01		✓			
CO-02			✓		
CO-03				✓	
CO-04					✓

## **COURSE CONTENTS**

<b>UNIT-I</b>	<b>Finite Differences and Interpolation</b> First and higher order differences - Forward differences and backward differences and Central Differences - Differences of a polynomial - Properties of operators - Factorial polynomials - Shifting operator E - Relations between the operators. Interpolation - Newton-Gregory Forward and Backward Interpolation formulae - Divided differences - Newton's Divided difference formula - Lagrange's Interpolation formula. <b>Application domain problems:</b> Approximation and error analysis
<b>UNIT-II</b>	<b>Numerical Solution of Equations, Differentiation and Numerical integration</b> Bisection Method, Newton-Raphson method - Gauss Elimination method - Gauss Jacobi method - Gauss Seidel method. Numerical Differentiation and Integration: Newton's forward and backward differences formulae to compute first and higher order derivatives - The Trapezoidal rule - Simpson's one third rule and three eighth rule. <b>Application domain problems:</b> Finding the solution of complex problems of real-world problems
<b>UNIT-III</b>	<b>Numerical Solutions of Ordinary Differential Equations</b> Solution by Taylor's series - Euler's method, Modified Euler method - Runge - Kutta methods of second and fourth orders. <b>Application domain problems:</b> Finding the solution of nonlinear problems in real world
<b>UNIT-IV</b>	<b>Statistics</b> Introduction, Measures of Central tendency and dispersion, Moments - Skewness and kurtosis based on moments. <b>Application domain problems:</b> To Analyze, interpret, and make predictions from the data

### **TEXT BOOKS**

1. Grewal B.S., "Numerical Methods in engineering and science", 11th Edition Mercury Learning and Information, 2018.
2. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited, 5th Edition, 2012.
3. Balagurusamy E., Computer Oriented Statistical and Numerical Methods- Laxmi Publications, 2009.

### **REFERENCE BOOKS:**

1. Jain M.K., Iyengar S. R. K. and Jain R.L., Numerical Methods for Scientific and Engineering Computation, NEW AGE; 6th edition, 2019.
2. Gupta S.C. and Kapoor V. K. , Fundamental of Mathematical Statistics, S Chand Publications, New Delhi, 12th edition, 2020

<b>PROBABILITY &amp; RANDOM PROCESS</b>	
Course Code: 24MDC101B	Internal Examination: 40 Marks
Credits: 3	External Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Engineering Mathematics-III	

### **COURSE OBJECTIVE (CEOs)**

1. To familiarize the students with concepts of random variables, two dimensional random variables, distributions, random processes and linear systems with random inputs that are used in many engineering problems.
2. To introduce basic Probability theory and Random variables, its types and concept of moments.
3. To equip the students with the knowledge of Discrete and continuous probability distributions with their applications.
4. To get exposed to the students with the knowledge of two dimensional Random variables and their transformations.
5. To extend the concept of random variable to random process and its basics that are applicable in engineering problems.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate knowledge of basic probability & random variables.
2. To understand techniques of developing discrete & continuous probability distributions and its applications.
3. Describe a random process in terms of its mean and correlation functions.
4. Gain knowledge in special processes like Poisson, Renewal processes.
5. Gain knowledge in spectral density, linear systems with random inputs.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

<b>CO</b>	<b>CLO</b>	<b>CLO-01</b>	<b>CLO-02</b>	<b>CLO-03</b>	<b>CLO-04</b>	<b>CLO-05</b>
<b>CO-01</b>		✓				
<b>CO-02</b>			✓			
<b>CO-03</b>				✓		
<b>CO-04</b>					✓	
<b>CO-05</b>						✓

## **COURSE CONTENTS**

### **Unit-I: Random Variables & Probability Distributions**

Random variables, Discrete Random Variables, probability mass functions; continuous random variables, probability density functions, Expectation, Moments - Moment generating function,

Bernouli distribution, Binomial distribution, Poisson distribution, Geometric distribution, uniform Distribution, Exponential distribution, Normal distributions,

### **Unit-II: Two Dimensional Random Variables**

Two dimensional Random Variables - Marginal and conditional distributions, Conditional mean and variance, covariance, correlation and Linear regression - Transformation of Random Variables.

### **Unit-III: Random Processes, Correlation and Power Spectral Densities**

Classification of Random processes - Stationarity - WSS and SSS processes, Random telegraph process, Ergodicity of Random Process, Poisson Random process, Autocorrelation function and its properties - Cross Correlation function and its properties. Spectral density function- Auto power spectral density and Cross power spectral density.

### **Unit-IV: Linear Systems with Random Inputs**

Linear time and invariant system, system transfer function. Linear system with random inputs. System in the form of convolution - Unit Impulse Response of the System - Weiner-Khinchine Relationship.

## **TEXT BOOKS/ REFERENCE BOOKS**

1. Veerarajan, T, Probability, Statistics and Random Processes, TMH, New Delhi, 2019.
2. Walpole R. E., Myers S. L., Ye K., Probability and Statistics for Engineers and Scientists, Pearson, 2017.
3. Moorthy M.B.K., Subramani K, Santha A. Probability and Random process. SciTech Publications, 7th edition 2018.
4. Trivedi K S, Probability and Statistics with reliability, Queueing and Computer Science Applications, Wiley-Blackwell; 2<sup>nd</sup> Edition, 2001.

<b>BIOSTATISTICS</b>	
Course Code: 24MDC101C	Continuous Evaluation:40 Marks
Credits:3	End Semester Examination:60 Marks
LTP:3 0 0	
Prerequisite: Nil	

### **COURSE OBJECTIVES (CEOs)**

1. The objective of the course is to make the students familiar with basic of probability
2. The course is providing probability applications in biomedical engineering.
3. The basics of probability, conditional probability and Baye's theorem.
4. Understand the random variable and probability distributions.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP-2020). After completion of course, students would be able to explain

1. All descriptive statistics
2. Basic statistical concepts of probability.
3. Correlation and Regression analysis.
4. Testing of hypotheses.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUT COMES (CLOs)**

<b>CO \ CLO</b>	<b>CLO</b>	<b>CLO-01</b>	<b>CLO-02</b>	<b>CLO-03</b>	<b>CLO-04</b>
<b>CO-01</b>		✓			
<b>CO-02</b>			✓		
<b>CO-03</b>				✓	
<b>CO-04</b>					✓

### **COURSE CONTENTS**

#### **Unit-I: Graphical Representation and Descriptive Statistics**

Quantitative and Qualitative Variables, Frequency Tables, Histograms, Bar Chart, Pie Chart, Box Plot, Measures of central tendency: Mean, Median and Mode, Measures of dispersion: Range, Standard Deviation and Variance, Measures of Position :Quartiles and Percentiles.

#### **Unit-II: Probability Theory**

Introduction of Probability, Mutually Exclusive Events, Independent vs Dependent events, Experiment, Outcomes, Events and Sample Space, Conditional Probability, Total Probability and Bayes' theorem.

#### **Unit-III: Correlation and Regression**

Introduction to Correlation and regression. Correlation model, correlation coefficient, multiple correlation. Simple linear regression, multiple regression.

#### **Unit-IV: Testing of Hypothesis**

Type I error and Type II error and power of test. Hypothesis testing for- population means, difference of two population means, population proportions, difference between two population proportions, population variance, ratio of two population variances. Chi-square

test: test of goodness of fit, independence and heterogeneity.

**TEXT BOOKS/REFERENCE BOOKS**

1. Gupta, S.C. and Kapoor, V.K. , Fundamental of Mathematical Statistics, S Chand Publications, New Delhi 2017
2. Mann , P.S. ,Introductory Statistics, John Wiley& Sons, Global edition, 2017.
3. Daniel, W.W., Biostatistics- A foundation for analysis in health sciences, John Wiley & Sons;11th Edition, EMEA edition, 2019.
4. Lipschutz, Seymour and Schiller, John , Introduction to Probability and Statistics, Tata McGraw Hill,2017.
5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists,9<sup>th</sup> Edition, Prentice Hall,2017.

<b>NUMERICAL METHODS</b>	
Course Code: 24MDC101D	Internal Examination: 40 Marks
Credits: 3	External Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Engineering. Mathematics – II	

### **COURSE OBJECTIVES (COs)**

1. To have a clear perception of the power of numerical techniques, ideas.
2. To demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
3. To make familiar with error analysis and some numerical methods to solve equations which are not easily solved by algebraic methods.
4. To familiar with different operators which are useful in Numerical Analysis and introduce the concept of interpolation

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Find solutions by various numerical methods to get approximation solutions of algebraic transcendental, simultaneous linear equations.
2. Get interpolating values by different numerical methods.
3. Do differentiation and integrations of tabular data.
4. To find numerical solutions of ordinary and partial differential equations.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01	✓			
CO-02		✓		
CO-03			✓	
CO-04				✓

## **COURSE CONTENTS**

### **Unit-I: Error Analysis and Numerical Solution of Equations**

Approximations and error in computation: Significant figures, approximate numbers, Errors: Round-off Errors, Truncation Errors, Absolute Relative and Percentage Errors, Error in approximation of a function and series, Solution of algebraic and transcendental equation: basic properties of equation, Bisection method, Newton-Raphson method. Solution of simultaneous equations: Gauss Elimination method, Gauss Jacobi method, Gauss Seidel method.

### **Unit-II: Differences and Interpolation**

Finite differences - Forward differences and backward differences, shifting operator E - Difference tables, relation between operators, Differences of a polynomial - Factorial polynomials -. Interpolation with equal intervals: Newton- Forward and Backward Interpolation formulae, Interpolation with unequal interval: Divided differences - Newton's Divided difference formula - Lagrange's Interpolation formula.

### **Unit-III: Numerical Differentiation and Integration**

Numerical Differentiation: Newton's forward and backward differences formulae to compute first and higher order derivatives, Numerical Integration: The Trapezoidal rule - Simpson's one third rule and Simpson's three eighth rule.

### **Unit-IV: Numerical Solutions of Ordinary and Partial Differential equations**

Solution by Taylor's series - Euler's method - Improved and modified Euler method - Runge-Kutta methods of second and fourth orders (No proof). Classification of Partial differential equations of the second order - Difference quotients - Laplace's equation and its solution by Liebmann's process

## **TEXT BOOKS/ REFERENCE BOOKS**

1. B.S. Grewal, "Numerical Methods in engineering and science", Khanna Publishers, 42nd Edition, 2015.
2. Steven Chapra and Raymond Canale, Numerical Methods for Engineers, 8th Edition, McGraw Hill, 2020.
3. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 1999
4. Gerald C. F., Wheatley P. O., Applied Numerical Analysis, Pearson, 2011.
5. Arumugam S., Isaac A. T., Somasundaram A., Numerical Methods, Scitech Publications Pvt. Ltd, 2009.
6. S.S. Sastry, Introductory Methods of Numerical Analysis, 2012.
7. E. Balagurusamy, Computer Oriented Statistical and Numerical Methods- Laxmi Publications, 2009.

<b>NUMERICAL METHODS IN BME</b>	
Course Code: 24MDC106A	Internal Examination: 40 Marks
Credits: 3	External Examination: 60 Marks
L T P : 3 0 0	
Prerequisite:	

### **COURSE EDUCATIONAL OBJECTIVES (CEOs)**

1. To have a clear perception of the power of numerical techniques, ideas.
2. To demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
3. To become familiar with error analysis and some numerical methods to solve equations which are not easily solved by algebraic methods.
4. To familiar with different operators which are useful in Numerical Analysis and introduce the concept of interpolation

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Find solutions by various numerical methods to get approximation solutions of algebraic transcendental, simultaneous linear equations.
2. Get interpolating values by different numerical methods.
3. Do differentiation and integrations of tabular data.
4. To find numerical solutions of ordinary and partial differential equations.

### **MAPPING BETWEEN COURSE EDUCATIONAL OBJECTIVES (CEOs) AND COURSE LEARNING OUTCOME (CLOs)**

<b>CLO</b>	<b>CLO-01</b>	<b>CLO-02</b>	<b>CLO-03</b>	<b>CLO-04</b>
<b>CEO-01</b>	✓			
<b>CEO-02</b>		✓		
<b>CEO-03</b>			✓	
<b>CEO-04</b>				✓

## **COURSE CONTENTS**

<b>UNIT-I</b>	<b>Error in Computation and Numerical Solution of Equations</b> Approximations and error in computation: Significant figures, approximate numbers, Errors: Round- off Errors, Truncation Errors, Absolute Relative and Percentage Errors, Solution of algebraic and Transcendental equation: basic properties of equation, Bisection method, Newton-Raphson method Solution of simultaneous equation: Gauss Elimination method, Gauss Jacobi method, Gauss Seidel method. <b>Application domain problems:</b> Error Analysis
<b>UNIT-II</b>	<b>Interpolation with Equal and Unequal Interval</b> Finite differences - Forward differences and backward differences, difference tables, Interpolation with equal intervals: Newton- Forward and Backward Interpolation formulae, Interpolation with unequal interval: Divided differences - Newton's Divided difference formula - Lagrange's Interpolation formula. <b>Application domain problems:</b> To estimate missing data and make predictions
<b>UNIT-III</b>	<b>Numerical Differentiation and Integration</b> Numerical Differentiation and Integration: Newton's forward and backward differences formulae to compute first and higher order derivatives - The Trapezoidal rule - Simpson's one third rule and three eighth rule. <b>Application domain problems:</b> Approximation, error analysis.
<b>UNIT-IV</b>	<b>Numerical Solutions of Differential Equations</b> Solution by Taylor's series - Euler's method - Improved and modified Euler method - Runge - Kutta methods of fourth order (No proof). <b>Application domain problems:</b> Finding the solution of complex problems in BME

## **TEXT BOOKS**

1. Grewal B.S., "Numerical Methods in engineering and science", 11th Edition Mercury Learning and Information, 2018.
2. Steven Chapra and Raymond Canale, Numerical Methods for Engineers, McGraw-Hill Education, 8th edition 2020.
3. Gerald C. F., Wheatley P. O., Applied Numerical Analysis, Pearson, 2011.
4. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited, 5th Edition, 2012.

## **REFERENCE BOOKS**

1. Balagurusamy E., Computer Oriented Statistical and Numerical Methods- Laxmi Publications, 2009.
2. Jain M.K., Iyengar S. R. K. and Jain R.L., Numerical Methods for Scientific and Engineering Computation, NEW AGE; 6th edition, 2019.
3. Kandasamy P., Thilagavathy K. and Gunavathi K., Numerical Methods, S Chand & Company; Reprint Edition, 2006.

<b>DISCRETE MATHEMATICS</b>	
Course Code: 24MDC 106B	Internal Examination: 40 Marks
Credits: 3	External Examination: 60Marks
L T P : 3 0 0	
Prerequisite:	

### **COURSE OBJECTIVES (COs)**

1. To introduce most of the basic terminologies for Logical and Mathematical maturity that impart analytical ability to describe, analyze and solving mathematical problems
2. To get an idea about recurrence relation & algebraic systems.
3. To familiarize the students with Boolean algebra and its terminologies.
4. To solve practical problems to the respective branches of Engineering in a logical and systematic fashion

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Write an argument using logical notation and determine if the argument is or is not valid.
2. Understand the basic principles of sets and operations in sets and prove basic set equalities.
3. Understanding recurrence relation and properties of algebraic structures such as groups, rings and fields.
4. Get an idea of Boolean algebra and its applications.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)**

CO \ CLO	CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01		✓			
CO-02			✓		
CO-03				✓	
CO-04					✓

## **COURSE CONTENTS**

### **Unit-I: Mathematical Logic**

Propositions and Logical operators - Truth tables and propositions generated by a set -Equivalence and Implication - Tautologies - Laws of logic - Proofs in Propositional calculus -Direct proofs - Conditional conclusions - Indirect proofs - Propositions over a universe -Mathematical Induction - The existential and universal quantifiers - Predicate calculus including theory of inference.

### **Unit-II: Set Theory & Relations**

Laws of Set theory - Partition of a set – Relations – Binary relation - Domain and range of a relation– Inverse relation – Composite relation – Equivalence relation – Equivalence classes – Partitions – Quotient set – Graphs of relations - Hasse diagram - Matrices of relations - Closure operations on relations -Warshall's algorithm

### **Unit-III: Recurrence Relation & Algebraic Systems**

Recurrence relations - Solving a recurrence relation - Recurrence relations obtained from solutions - Generating functions - Solution of a recurrence relation using generating functions- Closed form expression for generating function. Groups - Cyclic groups and subgroups -Normal subgroups - Coding theory - Group codes.

### **Unit-IV: Boolean Algebra, Posets and lattices**

Definitions and Basic Properties of Boolean Algebra, Boolean Expressions, Logic Gates and Circuits, Boolean Function - Method to find Truth Table of a Boolean Function – Disjunctive Normal Form or Canonical Form - Karnaugh map. Posets– Hasse Diagram, Chain and anti-chain, Dual of a poset- Isomorphic posets. Lattices –Properties of Lattices, sub-lattices, well ordered set - complete order - Complete lattice - Lattice Homomorphism. Application of Boolean algebra to switching theory.

## **TEXT BOOKS / REFERENCE BOOKS**

1. B. Kolman, R. Busby, and S. C. Ross., Discrete Mathematical Structure, 6<sup>th</sup>edition.,Pearson's Publication,2017.
2. Sarkar S. K., Discrete Mathematics, S Chand & Co Ltd2016. Prentice Hall India Learning Private Limited; Second edition, 2014.
3. Kenneth H. Rosen, Discrete Mathematics and its application, Tata Mcgraw Hill, 7th edition, 2017.
4. Bondy J. A., Murty U. S. R., Graph Theory, Springer, 2013.
5. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 4<sup>th</sup> edition,2017.
6. Yadav S. K., Discrete Mathematics with Graph Theory, Anne Books Pvt. Ltd., 2013.

<b>Year/Semester</b>	<b>3<sup>rd</sup> /5<sup>th</sup></b>	<b>Course Category</b>	<b>Multidisciplinary Course (MDC)</b>
<b>Course Code</b>	<b>23MDC301</b>	<b>Course Title</b>	<b>IPR for Business</b>
<b>Continuous Evaluation: 40</b>		<b>End Semester Examination: 60</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 3 0 0</b>	<b>Credits: 3</b>

### **COURSE OBJECTIVES:**

The objective of this Multidisciplinary Course (MDC) is to familiarize the students with various types of IPR and its relevance to the businesses and their respective streams.

1. To provide students with a basic understanding of various types of IPR and its relevance for business.
2. To acquaint students with the strategies and management techniques associated with intellectual property assets, and the legal considerations and challenges involved.
3. To familiarize the students with the challenges and legal considerations related to intellectual property disputes.
4. To develop skills related to management of intellectual property in business.

### **COURSE LEARNING OUTCOMES**

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

1. Define and discuss the various types of IPR and its relevance for business.
2. Discuss the adjudicating bodies and mechanisms under each of these IPRs.
3. Analyze and resolve business disputes relating to IPR.
4. Apply the learning to the real-life situations in business

### **MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)**

<b>COURSE OBJECTIVES (COs)</b>	<b>COURSE LEARNING OUTCOMES (CLOs)</b>			
	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>
<b>CO1</b>	√			
<b>CO2</b>		√		
<b>CO3</b>			√	
<b>CO4</b>				√

### **COURSE CONTENT**

#### **UNIT 1**

#### **INTRODUCTION TO INTELLECTUAL PROPERTY AND BUSINESS**

- Concept of IPR in business and its types
- International Context - Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO), World Trade Organization (WTO) and the UNESCO
- Innovation as a Business Strategy and relevance of protecting the ideas legally
- National IPR Policy

#### **UNIT 2**

#### **COPYRIGHT**

- Concept of Copyright and importance for businesses
- Media business – protecting performer's rights
- Performers' and Broadcasters' Rights Law
- Assignment, Transmission, Licensing of Copyrights
- Infringement of Copyrights and remedies

#### **UNIT 3**

#### **TRADEMARKS**

- Trademark – value of and relevance for businesses
- Protecting brand value- acquiring trademark nationally and internationally
- Trade mark disputes – case studies

#### **UNIT 4**

##### **PATENTS**

- Protecting innovation – acquiring patents nationally and internationally
- Product and process patents
- Assigning patents and its commercialization
- Patent Disputes

#### **UNIT 5**

##### **INDUSTRIAL PROPERTIES**

- Industrial designs – protection - Procedure for Registration of Designs • Copyright under Design
- Semiconductor Integrated Circuits Layout-Designs
- Plant varieties – commercialization - Monsanto cases
- Geographical Indications
- Biotechnology and IPR

#### **UNIT 6**

##### **REGISTRATION AND ENFORCEMENT MECHANISMS**

- Registration authorities of various IPRs
- IP Management and assertion of rights through declarations – use of copyright, trademark signs
- IP Litigation – Approach of courts – landmark cases

##### **TEXT BOOKS:**

- WIPO DL-101 General Course on Intellectual Property (online)
- Elizabeth Verkey and Jithin Saji Issac, *Intellectual Property*, Eastern Book Company 2021
- Anurag K. Agarwal, *Business and Intellectual Property: Protect your Ideas*, IIM Ahmedabad. Random House India (2016)
- *Handbook on IP Commercialisation - Strategies for Managing IPRs and Maximising Value* Jakarta: ASEAN Secretariat, November 2019

##### **REFERENCES BOOKS:**

- ICSI Study Material, Intellectual Property Rights: Law and Practice, A. Ramaiya, Guide to the Companies Act, LexisNexis, 19th Ed. 2020 (in 6 volumes)
- WIPO, *Enterprising Ideas A Guide to Intellectual Property for Startups*, 2023
- Manuals published by Office of the Controller General of Patents, Designs & Trade (CGPDTM), available at <https://ipindia.gov.in/>
- Guide Books by WIPO –Intellectual Property for Business, available at <https://www.wipo.int/publications/en/series/index.jsp?id=181>

<b>Year/Semester</b>	<b>3<sup>rd</sup> / 6<sup>th</sup></b>	<b>Course Category</b>	<b>Multidisciplinary Course</b>
<b>Course Code</b>	<b>23MDC304</b>	<b>Course Title</b>	<b>Indian Economy</b>
<b>Continuous Evaluation: 40</b>		<b>End Semester Examination:60</b>	
<b>Prerequisite: Nil</b>		<b>L T P : 3 0 0</b>	<b>Credits: 3</b>

### **COURSE OBJECTIVES**

1. To introduce different demography terms and trends.
2. To make students familiar with growth and its distribution.
3. To discuss the major changes in the agriculture sector over-time.

### **COURSE LEARNING OUTCOMES**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. review major demographic indicators
2. comprehend the concept of inequality
3. analyse agriculture sector

### **MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES**

<b>Course Objectives (COs)</b>	<b>Course Learning Outcomes (CLOs)</b>		
	<b>CLO 1</b>	<b>CLO 2</b>	<b>CLO 3</b>
<b>CO 1</b>			
<b>CO 2</b>			
<b>CO 3</b>			

### **COURSE CONTENTS**

#### **Unit-I**

Population and Human Development

Demographic trends and issues; education; health and malnutrition. Demographic features of India's population.

#### **Unit-II**

Growth and Distribution

Trends and policies in poverty; inequality and unemployment.

#### **Unit-III**

Agriculture

Importance of Agriculture; Causes of backwardness and low productivity; Land Reforms: Need, Implementation and Critical Evaluation

### **TEXT BOOKS:**

1. Jean Dreze and Amartya Sen, 2013. *An Uncertain Glory: India and its Contradictions*, Princeton University Press.
2. Pulapre Balakrishnan, 2007, *The Recovery of India: Economic Growth in the Nehru Era*, *Economic and Political Weekly*, November.
3. Rakesh Mohan, 2008,—*Growth Record of Indian Economy: 1950-2008. A Story of Sustained Savings and Investment*, *Economic and Political Weekly*, May.
4. S.L. Shetty, 2007,—*India's Savings Performances since the Advent of Planning*, in K.L. Krishna and A. Vaidyanathan, editors, *Institutions and Markets in India's Development*.
5. Himanshu, 2010,—*Towards New Poverty Lines for India*, *Economic and Political Weekly*, January.

<b>PROBABILITY AND STATISTICS</b>	
Course Code: 24MDC605	Internal Examination: 40 Marks
Credits: 3	External Examination: 60Marks
L T P : 3 0 0	
Prerequisite: Nil	

### **COURSE OBJECTIVES**

1. To provide students with a fundamental understanding of probability theory and random variables.
2. To provide students with a comprehensive understanding of curve fitting techniques.
3. To equip students with the fundamental concepts of time series analysis, including trend identification, stochastic component characterization, and exploratory techniques for modeling and forecasting.
4. To provide students with a comprehensive understanding of time series analysis, including backshift operators, differencing, stationarity tests, and the modeling of AR, MA, ARMA, and ARIMA processes for forecasting.

### **COURSE LEARNING OUTCOMES (CLOs)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Compute moments, derive moment generating functions for various distributions, and apply probability theory concepts to solve problems involving random variables and their transformations, while utilizing Chebyshev's inequality for probabilistic bounds.
2. Apply appropriate statistical techniques (ANOVA, multiple comparison tests, and curve fitting) to analyze experimental data and draw valid conclusions.
3. Analyze time series data by decomposing trends, identifying stochastic properties, and applying appropriate methods for trend elimination and growth curve fitting.
4. Apply autoregressive (AR), moving average (MA), and ARIMA modeling techniques to analyze and forecast time series data using appropriate statistical tools and software.

### **MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES**

CO \ CLO	CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01		✓			
CO-02			✓		
CO-03				✓	
CO-04					✓

### **COURSE CONTENTS**

<b>UNIT-I</b>	<p><b>Random variables and Probability Distributions</b>  Probability theory - Random Variables - Moments - Moment generating function - Binomial, Poisson, Geometric, Exponential, Normal distributions, functions of Random Variables, Chebyshev inequality.  <b>Application domain problems:</b> Network Traffic Modeling and Performance Analysis</p>
<b>UNIT-II</b>	<p><b>Regression, ANOVA and Multiple Comparison Tests</b>  Fitting of polynomial and exponential curves. ANOVA, one way and two-way classifications. Random effects. Multiple Comparison Tests - Least Significant Difference, Student-Newman-Keuls test, Duncan's Multiple Range test, Tukey's test.  <b>Application domain problems:</b> Predicting software development effort</p>
<b>UNIT-III</b>	<p><b>Time Series</b>  Time Series – Concept, Objectives of Time Series Analysis - Trends and characteristics of stochastic components of time series - Exploratory Time Series Data Analysis - Elimination of trend – Growth curve.  <b>Application domain problems:</b> Network security and performance monitoring in real-time systems.</p>
<b>UNIT-IV</b>	<p><b>Stationary Time Series Models</b>  Backshift Operator, Differencing, and Stationarity Test - Moving Average Models - Autoregressive Models - Autoregressive Moving Average (ARMA) Models - ARMA and ARIMA Modelling and Forecasting.  <b>Application domain problems:</b> Network Traffic Forecasting and Anomaly Detection</p>

#### TEXT BOOKS

1. Gupta S.C. and. Kapoor V.K, "Fundamental of Mathematical Statistics", S. Chand, 12th Edition, New Delhi, 2020.
2. Ross S., "A first Course in Probability", Pearson Education, India, 2010

#### REFERENCE BOOKS

1. Veera Rajan ,T, "Probability and Statistics," TMH, New Delhi-2010
2. Rohatagi V.K., Ehsan's Saleh A.K.Md., "An Introduction to Probability and Statistics," Wiley, Oxford, 2nd Ed. 2008.

<b>Year/Semester</b>	<b>3<sup>rd</sup> / 6<sup>th</sup></b>	<b>Course Category</b>	<b>MDC</b>
<b>Course Code</b>	<b>23MDC305</b>	<b>Course Title</b>	<b>Electoral Literacy in India</b>
<b>Continuous Evaluation : 40</b>		<b>End Semester Examination : 60</b>	
<b>Prerequisite: Nil</b>		<b>L T P : 3 0 0</b>	<b>Credits: 3</b>

**Course Objectives (CO)** - The Course is designed with the following objectives:

1. To know the meaning and nature of the electoral democracy in India
2. To discuss electoral institutions in India
3. To understand the procedural aspect of elections in India
4. To grasp the significance of elections and electoral aspects of democracy, the electoral model code of conduct, issues, and challenges in India's democracy.

**Course Learning Outcomes (CLO)** - The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

1. The student shall be able to understand the meaning, definition, and significance of elections in India.
2. The course will help the students to analyse and understand electoral institutions, and their role and functions in the conduct of free and fair elections.
3. The student shall be able to know the party system of India.
4. The course will help the student understand issues and challenges in conducting free and fair elections in India.

**Mapping Matrix between Course Objectives and Course Learning Outcomes:**

<b>Course Learning Objectives (Cos)</b>	<b>Course Learning Outcome (CLOs)</b>				
	<b>CLO1</b>	<b>CLO2</b>	<b>CLO3</b>	<b>CLO4</b>	<b>CLO5</b>
<b>C01</b>	√				
<b>C02</b>		√	√		
<b>C03</b>			√	√	
<b>C04</b>					√

**COURSE CONTENTS:**

**UNIT-1: Elections in India**

- Suffrage, Types, and Methods of Elections
- Parliamentary elections: Lok Sabha & Rajya Sabha
- Presidential Elections
- State Legislative Assembly Elections
- Local Body Elections

**UNIT-2: Electoral Institutions**

- Election Commission (EC)
- State Election Commission
- Constitution: Part-15

**UNIT-3: Political Parties in India**

- One-party, Two Party, Multi-party system
- Model Code of Conduct, Party Funding, and Campaign

**UNIT-4: Elections: Issues and Challenges**

- Issues and challenges

**RECOMMENDED TEXTBOOKS:**

1. Subhash C. Kashyap, Our Political System, 2nd, National Book Trust, India, 2008, ISBN: 8123752520
2. D. D. Basu, Introduction to The Constitution Of India, 26<sup>th</sup> Edition, Lexis Nexis, ISBN: 978-9388548861
3. Bidyut Chakrabarty, Rajendra Kumar Pandey, Indian Government and Politics, Sage Text, ISBN: 8132100581

**REFERENCE BOOKS:**

1. Sanjay Kumar, Elections in India: An Overview, 1st, Routledge, ISBN: 9781032033136
2. <https://eci.gov.in/>
3. <https://www.lokniti.org/>
4. Websites of State Election Commission
5. NCERT, Chapter-3 Indian Constitution at Work

<b>Creating Entrepreneurial Mind Set</b>	
<b>Course Code: 23MDC402</b>	<b>Continuous Evaluation: 40 Marks</b>
<b>Credits: 3</b>	<b>End Semester Examination:60 Marks</b>
<b>L T P : 3-0-0</b>	<b>Course Type: MDC</b>

### **COURSE OBJECTIVES**

1. To disseminate knowledge about basics of entrepreneurship and forms of ownership.
2. To enlighten students regarding the relevance of creativity and innovation from an entrepreneurship point of view.
3. To give clarity to students regarding formulation of business plan.
4. To familiarize students with the upcoming trends in the entrepreneurship field.

### **COURSE LEARNING OUTCOMES**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand basics of entrepreneurship and different types of ownerships.
2. Grasp relevance of creativity and innovation and its application in a business.
3. Acknowledge components of a business plan and ways to launch it.
4. Utilize conceptual building skills in interpreting trends for the entrepreneurs.

### **MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES**

<b>Course Objectives (COs)</b>	<b>Course Learning Outcomes (CLOs)</b>			
	<b>CLO 1</b>	<b>CLO 2</b>	<b>CLO 3</b>	<b>CLO 4</b>
<b>CO 1</b>				
<b>CO 2</b>				
<b>CO 3</b>				
<b>CO4</b>				

### **COURSE CONTENTS**

<b>UNIT</b>	<b>CONTENTS</b>
<b>UNIT-I</b>	<b>Basics of Entrepreneurship</b> Entrepreneur: Definition, characteristics, functions, types of an entrepreneur; Concept of Entrepreneurship, types, role of entrepreneurship in economic development, Factors affecting Entrepreneurship.
<b>UNIT-II</b>	<b>Entrepreneurial Development Programme</b> Entrepreneurial Development Programme (EDP): meaning & concept; The Role and Relevance of Entrepreneurial Development Program in India; Role of Government in Organizing EDP's Critical Evaluation; Women Entrepreneurship- Meaning, Reasons for Slow Growth, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship.
<b>UNIT-III</b>	<b>Business Planning</b> Opportunity Identification and selection, Formulation of business plan, External Environmental Analysis - Economic, Social, financial, technological, competitive, and legal. Financing: Sources, venture capital, export finance.
<b>UNIT-IV</b>	<b>Entrepreneurial Trends in the Digital Age</b> Definition and significance of digital entrepreneurship; Brief overview of key digital trends impacting businesses; Disruptive

**TEXT BOOKS**

1. Burns, Entrepreneurship and small business, 4<sup>th</sup> edition (2016), Palgrave.
2. Norman M. Scarborough, Essentials of entrepreneurship and small business management, 9<sup>th</sup> edition (2018), Pearson.
3. Hisrich, R., & Peters, M., Entrepreneurship, 11<sup>th</sup> edition (2020), Tata McGraw Hill.
4. Prahalad, C. K. (2006). Fortune at the bottom of the pyramid, eradicating poverty through profits. Wharton school Publishing.
5. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries

**SUGGESTED READINGS**

1. Khandwalla, P., Corporate creativity, 7<sup>th</sup> edition (2017), Tata Mc. Graw Hill.
2. Mullins, J., New business road test, 4<sup>th</sup> edition (2013), Prentice Hall.
3. Drucker, P. F. (2006). Innovation and entrepreneurship: Practice and principles. USA: Elsevier.
4. Gersick, K. E., Davis, J. A., Hampton, M. M., & Lansberg, I. (1997). Generation to generation: Life cycles of the family business. Boston: Harvard Business School Press.
5. Holt, D. H. (2004). Entrepreneurship new venture creation. New Delhi: Prentice Hall of India.

<b>Year/Semester</b>	3 <sup>rd</sup> / 5 <sup>th</sup>	<b>Course Category</b>	<b>MDC</b>
<b>Course Code</b>	23MDC303	<b>Course Title</b>	<b>Psychology and Emotional Intelligence</b>
<b>Continuous Evaluation : 40</b>		<b>End Semester Examination : 60</b>	
<b>Prerequisite: Nil</b>		<b>L T P : 3 0 0</b>	<b>Credits: 3</b>

### **COURSE OBJECTIVES (COs):**

1. To know the concepts in sociology relevant to the study of society.
2. To discuss classical sociological thoughts by sociologists.
3. To understand modern and post modern sociological thoughts.
4. To grasp the significance of sociological theories in understanding society.
5. To construct the relation between individual and social structure in the society.

### **COURSE LEARNING OUTCOMES (CLOs):**

After the successful completion of the course, the students will have the ability to:

1. Explain various sociological concepts important in the understanding of society.
2. Application of critical conceptual understanding that is central to sociological investigations.
3. Analyzing the social phenomena with respect to theoretical understanding of society.
4. Recommend analytical as well as methodological understanding to generate authentic knowledge.
5. Integrate the knowledge of social issues in society according to advanced, contemporary, interdisciplinary knowledge.

### **Mapping Matrix between Course Objectives and Course Learning Outcomes:**

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

### **COURSE CONTENTS**

#### **UNIT-I: INTRODUCTION**

- Definition, Scope, Nature and Importance of Sociology
- **SOME BASIC CONCEPTS:** Status & Role, Power & Authority, Social Structure & Function

#### **UNIT-II : SOCIETY AND SOCIAL BEHAVIOUR**

- **SOCIETY AND SOCIAL BEHAVIOUR:** Society: Meaning & Characteristics, Culture, Socialization: Definition & Agencies, Social Mobility: Meaning & Types, Social Group: Meaning and Types

#### **UNIT-III : SOCIAL CONTROLS & SOCIAL BEHAVIOUR**

- **MEANING AND NATURE OF SOCIAL CONTROL:** Social Controls & Social Behaviour : Types: Folkways, Mores, Norms, Values, Law
- **SOCIAL CONFORMITY AND DEVIANCE :** Meaning of Conformity & Deviance

#### **UNIT-IV: THEORETICAL PERSPECTIVES**

- **MACRO PERSPECTIVE:** Theoretical perspectives: Functionalism, Conflict, Structuralism.

#### **UNIT-V: CLASSICAL THEORISTS**

- **EMILE DURKHEIM:** Division of Labour in Society, Suicide
- **KARL MARX:** Historical Materialism, Class and Class Conflict, Alienation
- **MAX WEBER:** Authority, Social Action, Ideal Types

#### **UNIT-VI : THEORIES OF MODERNITY**

- Juggernaut of Modernity, McDonaldization, Risk Society
- **GLOBALIZATION AND INEQUALITY:** Global justice, Need for Global governance
- **MICRO PERSPECTIVE:** Theoretical perspectives: Symbolic Interactionism, Exchange Theory, Labelling Theory

#### **TEXT BOOKS**

1. Anthony Giddens, Sociology, Polity Press (2019)
2. Harlambos, M. Sociology: Themes and Perspectives, Oxford University Press
3. C.N. Shankar Rao, **Sociology: Principles Of Sociology With An Introduction To Social Thoughts**, S. Chand Publications, (2019)

#### **REFERENCE BOOKS**

1. Transformation: Theory and Society in India, Oxford University Press (2010)
2. Andre Beteille. Six Essays in Comparative Sociology, Oxford University Press
3. M. Francis, Abraham. Contemporary Sociology: An Introduction to Concepts and Theories, Oxford University Press (2014)
4. J.P.S. Uberoi. Mind and Society: From Indian Studies to General Sociology, Edited by Khalid Tyabji, Oxford University Press (2019).

<b>PERSONAL FINANCIAL PLANNING</b>	
<b>Course Code: 23MDC403</b>	<b>Continuous Evaluation: 40</b>
<b>Credits: 03</b>	<b>End Semester Examination: 60</b>
<b>L T P : 3-0-0</b>	<b>Course Type: MDC</b>
<b>Prerequisite:</b> Students should be aware about various saving schemes and their future benefits.	

### **COURSE OBJECTIVES**

1. Build an understanding to familiarize different aspects of personal financial planning.
2. Analyze and compare different sources of savings and investment.
3. Develop a perspective to understand necessary knowledge and skills for effective Tax planning.
4. Develop skills to assess need for insurance and retirement planning.

### **COURSE LEARNING OUTCOMES**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Analyze the meaning and appreciate the relevance of financial planning
2. Analyze the Integration of various avenues of investment for future benefit.
3. Examine the scope and ways of personal tax planning.
4. Analyze insurance and retirement planning with relevance.

### **MAPPING MATRIX COURSE OBJECTIVES & COURSE LEARNING OUTCOMES**

CLO CO	01	02	03	04
01	√			
02		√		
03			√	
04				√

### **COURSE CONTENTS**

UNIT NUMBER	Course contents
<b>UNIT-I</b>	<b>Introduction to Financial Planning</b> Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments.
<b>UNIT- II</b>	<b>Investment Planning</b> Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation, Various Investment avenues
<b>UNIT- III</b>	<b>Personal Tax Planning</b> Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income.

<b>UNIT- IV</b>	<b>Insurance and Retirement Benefits Planning</b> Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance, Pension plans available in India
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#### **TEXT BOOKS**

1. Halan, M. —Let's Talk Money: You've Worked Hard for It, Now Make It Work for You! Harper Collins Publishers, 2020 New York.
2. Madura, J. —Personal Finance, 2021, Pearson Publication
3. Indian Institute of Banking & Finance. —Introduction to Financial Planning, Taxmann Publication, 2021, New Delhi.
4. Keown A.J. —Personal Finance, Pearson Publication, 2021, New York.

#### **REFERENCE BOOKS**

1. Pandit, A. —The Only Financial Planning Book that You Will Ever Need, Network 18 Publications Ltd., Mumbai.
2. Sinha, M. —Financial Planning: A Ready Reckoner, McGraw Hill Education, New York.
3. Tripathi, V. —Fundamentals of Investment, Taxmann Publication, New Delhi.

## SYLLABUS OF VALUE ADDED COURSES

<b>Year/Semester</b>	2 <sup>nd</sup> Year/ 3 <sup>rd</sup> Semester	<b>Course Category</b>	VAC
<b>Course Code</b>	23 VAC 103	<b>Course Title</b>	Sports , Yoga & Fitness
<b>Continuous Evaluation : 80</b>		<b>End Semester Examination : 20</b>	
<b>Prerequisite: Nil</b>		<b>L T P :1 0 2</b>	<b>Credits: 2</b>

**Course Objectives (CO)** - The Course is designed with the following objectives:

1. To know about the physical body
2. To discuss about improve range of motion, mobility and coordination in body
3. To understand the ways to improve strength, balance and flexibility.
4. To grasp the significance of yoga and sports in fitness
5. To construct an environment for individual and community health.

**Course Learning Outcomes (CLO)**–The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to :(

**BLOOM'S TAXONOMY)**

1. Explain the role of yoga and fitness in life.
2. Apply the rules of healthy and fit life
3. Analyse the ways and methods of yoga and sports
4. Recommend the practices of Asanas and different sports
5. Integrate the concept of yoga and sports in all round development of students and beings.

**Mapping Matrix between Course Objectives and Course Learning Outcomes:**

	CLO1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	√				
CO 2		√			
CO 3			√		
CO 4				√	
CO 5					√

**COURSE CONTENTS:**

**UNIT-I: Health and Wellness**

- Meaning Definition and Importance of Health and Wellness
- Dimensions of Health and Wellness
- Role of Exercise in maintaining Health and Wellness
- Stress and Its management through Exercise
- Nutrition for Health and Wellness
- Practical-Exercise for Health and Wellness
  - ☐ Warming –Up
  - ☐ Stretching Exercises
  - ☐ Strengthening Exercises
  - ☐ Cardiovascular Exercises
  - ☐ Flexibility and Agility Exercises
  - ☐ Limbering Down
  - ☐ Relaxation Techniques (IRT, QRT, DRT etc.)

## **UNIT-II Yoga and Fitness**

- Importance of Yoga and Fitness
- Types and Principles of Asanas
- Fitness Components
- Specific Exercises for Strength, Flexibility, Speed, Agility & Coordinative Abilities
- Yoga, Fitness and Personality
- General Specific Warm up
- Aerobics / Zumba Dance
- Asanas
- Recreation for Fitness
- Report preparation, Records and PPT

## **UNIT-III Sports and Psychology**

- Definition of Sports Psychology
- Adolescence-Problems related with Adolescence i.e. physical problems, Peer
- group Relationship, Career Selection, Drug Abuse, Psychological and Emotion problems
- Importance of Sports Psychology

## **UNIT-IV Sports and Recreation**

- Meaning Definition and Concept of Sports Fitness and Recreation
- Objectives, Characteristics and principles of Sports Fitness and Recreation
- Importance, Purpose, Benefits of Fitness and Recreation
- Types of Recreation
- Recreation through Sports and Games
- Use of Leisure Time Activities and their educational values
- Traditional, Folk and Indigenous Games
- Three Days outdoor camp and Hiking
- Cycling, tie up with District/State Associations
- Visits to Recreational Clubs

## **RECOMMENDED TEXT BOOKS:**

1. Foundations of Physical Education, Chales A. Bucher
2. Foundations of Physical Education, M.L.Kamlesh
3. History and Principles in Physical Education, Dr. Karan Singh
4. Essentials of Physical Education, Dr. Ajmer Singh
5. Foundations of Physical Education, Dr. A.K.Uppal
6. Physical Education, Manu Sood, New SP Books
7. Health the basis of life: Dr. John Maclay
8. Natural Health & Yoga, Brij Bhushan
9. Health Education, S.K.Mangal
10. Essential of Physical Education, Dr. Ajmer Singh & Dr. Bains

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 23VAC102/202</b>	<b>Continuous Evaluation: 40 Marks</b>
<b>Credits: 2</b>	<b>End Semester Examination: 60 Marks</b>
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

### **COURSE OBJECTIVES (CO)**

1. To acquaint the students with legacies of constitutional development in India and help them to understand the most diversified legal document of India and philosophy behind it.
2. To make students understand the detailed analysis and importance of Fundamental Rights, their relationship with Directive Principles and the significance of Fundamental Duties.
3. To acquaint the students with the way social, political and economic justice could be realized.
4. To acquaint the students with the basic postulates of constitutional framework regarding the organization, powers and functions of the various organs of the State.
5. To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
6. To acquaint students with latest intellectual property rights, relating to patent & copyright and innovation environment with related regulatory framework.

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.
2. Differentiate different aspects of Indian Legal System and its related bodies
3. To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.
4. Know about the enforcement remedies available under the Constitution of India
5. To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy
6. To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

### **COURSE CONTENTS**

#### **Unit-I**

- Meaning of the Constitution, Constitutional Law and Constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution
- Indian Constitution and its Salient Features
- The Preamble of the Constitution
- Federal Nature of the Constitution
- Parliamentary System

#### **Unit-II**

- Fundamental Rights:
  - Right to Equality (Articles 14 to 18)
  - Right to Freedom (Articles 19 to 22)
  - Right against Exploitation (Articles 23 to 24)
  - Right to Freedom of Religion (Articles 25 to 28)
  - Cultural and Educational Rights (Articles 29 to 30)

- Directive Principles of State Policy (Article 36-51)
- Fundamental Duties (Article 51 A)

### **Unit-III**

- Powers and Functions of the President and the Prime Minister (Articles 52-62, 74-78)
- Powers of Indian Parliament: Functions of Rajya Sabha, Functions of Lok Sabha
- Centre-State Relations (Article 245-293) (Briefly refer Disaster Management Act 2005)
- Judiciary – Supreme Court: Appointment of Judges, Judicial Review, Writ jurisdiction (Article 32, 124,126) Functions of High Court and Subordinate Courts (Article 217, 224, 226, 233)
- Amendment of the Constitution: Powers and Procedure (Article 368)

### **Unit-IV**

- Regulation to Information- Introduction, Right to Information Act, 2005
- Information Technology Act, 2000
- Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement.

### **TEXT/REFERENCE BOOKS**

1. Brij Kishore Sharma: Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
2. Granville Austin: The Indian Constitution: Cornerstone of a Nation. 1966, Oxford Clarendon Press.
3. Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and Constitutional Law, NBT,2018.
4. P. M. Bakshi: The Constitution of India, Latest Edition, Universal Law publishing.
5. H.M. Seervai, Constitutional Law of India (4th Ed., Universal Law Publishing Co. Pvt. Ltd. 2008)
6. M.P. Jain, Indian Constitutional Law (6th Ed. Lexisnexis Butter worths Wadhwa, 2010)
7. J.N. Pandey, Constitutional Law of India (Latest Edition)
8. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
9. Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, NewDelhi-88
10. P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
11. Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, OrientL ongman.
12. BL Wadehra: Patents, Trademarks, Designs and Geological Indications. Universal Law Publishing -LexisNexis.
13. Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)

Environmental Bioengineering			
Year/Semester	1 <sup>ST</sup> /I or II	Course Category	
Course Code		Course Title	Environmental Bioengineering
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

**Course Objectives (CO) - The Course is designed with the following objectives:**

- To provide a comprehensive understanding of the relationship between humans and the environment.
- Aims to introduce students to the different components of the environment.
- To develop the understanding of pollution, its causes, and their effects
- To familiarize the students with the different biological concepts.

**Course Learning Outcomes (CLO) –** The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

- Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
- Demonstrate to safeguard the Earth’s environment and its resources.
- Explain sustainable development, its goals, challenges, and global strategies.
- Improve biological concepts using an engineering approach.

**MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)**

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)			
	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

**COURSE CONTENTS**

**Unit-1**

**Human and Environment**

Introduction to earth environment, Scope and importance. Components of the environment: Lithosphere, Hydrosphere, Biosphere, Atmosphere. The man- environment interaction, Population growth and natural resource exploitation, Industrial revolution, and its impact on the environment. Understanding of pollutant and pollution; Types of Pollution, Air pollution: Water pollution, Soil pollution and solid waste, Noise pollution, Thermal pollution and their impact on human health

**Unit-2**

**Natural Resources, Sustainable Development & Sustainable living**

Overview of natural resources, Classification of natural resources, Resources: Forests, wetlands, Status and challenges. Water resources: Types of water resources, issues and challenges; Soil and mineral resources, Energy resources: renewable and non-renewable sources of energy. Biodiversity and its distribution, Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges, and

strategies for SDGs. Ways to live in a sustainable manner- Conservation of energy, water at home, plantation, waste segregation, kitchen gardening.

### **Unit-3**

#### **Introduction of Bioengineering:**

Significance of biology, fundamental similarities, and differences between science and engineering- humans as the best machines, brain as a computer, comparison between eye camera, **Biomolecules:** molecules of the life -monomeric unit and polymeric structure, carbohydrates, proteins; nucleotides and lipids. bioengineering introduction and current status in Agriculture, Medicine (vaccine and biosensors) enzyme technology, and environment, and the role of artificial intelligence and robotics in human health monitoring.

### **Unit 4**

#### **Bioengineering in Environment Protection:**

What is environmental bioengineering? applications of bioengineering in the environment protection.—global environmental problems and bioengineering approaches for their management. sewage treatment, biofertilizers, biofuels, bioreactors, bioremediation, and bioengineering for biomedical waste management. role of artificial intelligence in handling biomedical waste.

#### **RECOMMENDED TEXT BOOKS:**

1. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
2. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
3. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
4. Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi
5. Biology: a Gopal approach Campbell, N.A Reece, J.B Urry, Lisa; Cain M.L Wasserman, S.A Minorsky, P. V Jackson, R. B Person Education ltd.

#### **REFERENCE BOOKS:**

1. A.K De Environmental Chemistry New age Publisher, 2016.
2. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
3. [www.ipcc.org](https://www.ipcc.org/); <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
4. Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards>.  
Principles of Biochemistry (V Edition) by Nelson, D.L; and Cox, M. M. W. H Freeman and company.

Department of Environmental Sciences			
Programme: Undergraduate program			
Year/Semester	1 <sup>ST</sup> /I or II	Course Category	Value Added Course (VAC)
Course Code	23VAC101/23VAC201	Course Title	Environmental Protection & Sustainable development
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

**Course Objectives (CO)** - The Course is designed with the following objectives:

- To provide a comprehensive understanding of the relationship between humans and the environment.
- Aims to introduce students to the different components of the environment.
- To develop the understanding of pollution, its causes, and their effects
- To gain the knowledge of climate change and the contemporary issues

**Course Learning Outcomes (CLO)** – The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

- Demonstrate to safeguard the Earth’s environment and its resources.
- Explain sustainable development, its goals, challenges, and global strategies.
- Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
- Appraise the concept of climate change, its science and response measures.

**MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)**

COURSE OBJECTIVES (COs)	COURSE LEARNING OUTCOMES (CLOs)			
	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

**COURSE CONTENTS**

**Unit-1**

**Human and Environment**

Introduction to earth environment, Scope and importance. Components of environment: Lithosphere, Hydrosphere, Biosphere, Atmosphere. The man- environment interaction, Population growth and natural resource exploitation, Industrial revolution, and impact on the environment, Global environmental challenges at global, regional and local level.

## **Unit-2**

### **Natural Resources, Sustainable Development & Sustainable living**

Overview of natural resources: Definition of resource; Classification of natural resources-, renewable, and non-renewable. Resources: Forests, wetlands, Status and challenges. Water resources: Types of water resources, issues and challenges; Soil and mineral resources: Important minerals; Environmental problems due to extraction of minerals, Soil as a resource and its degradation. Energy resources: renewable and non-renewable sources of energy. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges, and strategies for SDGs. Ways to live in sustainable manner- Conservation of energy, water at home, plantation, waste segregation, kitchen gardening.

## **Unit-3**

### **Conservation of Biodiversity and Ecosystems**

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Major ecosystem types in India and their basic characteristics, forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International instruments for biodiversity conservation: The role of traditional knowledge, community-based conservation. Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety, Ramsar Convention on Wetlands of International Importance, The Wildlife (Protection) Act, 1972, The Biological Diversity Act, 2002.

## **Unit-4**

### **Environmental Pollution and Health**

Understanding of pollutant and pollution; Types of Pollution, Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants, Indoor air pollution; Adverse health impacts of air pollutants, National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

## **Unit-5**

### **Climate Change: Impacts, Adaptation and Mitigation**

Understanding climate change: Natural variations in climate, Anthropogenic climate change from greenhouse gas emissions- past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events, Climate change projections for the Indian sub-continent. Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health. the concept of vulnerability, adaptation and resilience, Synergies between adaptation and mitigation measures, Concept of carbon neutrality, net zero targets, Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs).

## **Unit 6**

### **Case Studies and Field Work**

The students are expected to be engaged in one of the following or similar identified activities.

Field visits to identify local issues, make observations including data collection and prepare a brief report, or Documentation of campus biodiversity or Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.

**RECOMMENDED TEXT BOOKS:**

- 1) Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
- 2) Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
- 3) Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
- 4) Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi

**REFERENCE BOOKS:**

- 1) A.K De Environmental Chemistry New age Publisher, 2016.
- 2) "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
- 3) [www.ipcc.org](http://www.ipcc.org); <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>.
- 4) Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards/>

**SOFT SKILLS TRAINING MODULES/COURSES STRUCTURE SEMESTER WISE IN  
FACULTY OF ENGINEERING & TECHNOLOGY (UG COURSES)**

**SEMESTER - III**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Program me</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>2 / 3</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS351</b>	<b>Course Title</b>	<b>Effective Communication Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO):**

1. To define and understand communication and its process.
2. To make student practice on communication skills via LSRW approach via instructing, engaging, assessing and re engaging.
3. To enhance the confidence and motivation of a student by honing his communication skills.

**Training Learning Outcomes (TLO):**

**After the completion of the training, the student will have ability:**

1. To communicate effectively and interact with people with confidence.
2. To demonstrate and differentiate between various forms of communication.
3. To apply effective communication skills confidently, a student needs to get ahead in job and life.

**Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)**

<b>TLOs/TOs</b>	<b>TLO1</b>	<b>TLO2</b>	<b>TLO3</b>
T01	√		
T02	√	√	
T03		√	√

## COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT	Student Engagement Activity
Unit-I	<b>Verbal Communication Skills</b> <ul style="list-style-type: none"><li>• Communication Process &amp; its importance</li><li>• 7 C's of Communication</li><li>• Formal &amp; Informal Conversation</li><li>• Requirements of effective verbal communication</li></ul>	Conversation Cards Activity
Unit-II	<b>Nonverbal Communication Skills</b> <ul style="list-style-type: none"><li>• Importance of nonverbal skills in effective communication</li><li>• Types of nonverbal (body language) skills</li><li>• Barriers to nonverbal communication</li></ul>	Power of Body Language Activity
Unit-III	<b>Listening Skills</b> <ul style="list-style-type: none"><li>• Role of listening skills in effective communication</li><li>• Barriers to listening</li><li>• Overcoming listening barriers</li><li>• Empathetic listening &amp; avoiding selective listening</li></ul>	Chinese Whisper Activity
Unit-IV	<b>Reading &amp; Writing Skills</b> <ul style="list-style-type: none"><li>• Types of reading strategies to enhance improve reading skills</li><li>• Types of written communication</li></ul>	The What IF Activity
Unit- V	<b>Visual Communication</b> <ul style="list-style-type: none"><li>• Types of visual communication</li><li>• Importance of visual communication</li><li>• Picture narration/description technique</li></ul>	Interpret The Picture Activity

Learning Resources	
Text Book	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press,2019.

### **Pedagogy**

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### **Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Effective Communication Skills Course**

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Verbal Communication Skills	Speech Activity	15	Written Test	10
II	Non Verbal Communication Skills	Role Play	15		

III	Listening Skills	Oral Assessment / Written Assessment	10		
IV	Reading & Writing Skills		20	Viva	20
V	Visual Communication		10		

**SEMESTER -IV**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>2 / 4</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS452</b>	<b>Course Title</b>	<b>Teamwork &amp; Interpersonal Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO)**

1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
2. To equip the students with capability of handling stress and utilization of work time effectively.
3. To make the students understand the importance and application of Emotional Quotient, Critical Thinking & Problem Solving Skills.

**Training Learning Outcomes (TLO)**

**After the completion of the training, the student will have ability:**

1. To be confident working in a team and leading it as well.
2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>				
<b>Training Learning Outcomes (TLO) Training Objectives(TO)</b>	TLO1	TLO2	TLO3	TLO4
T01	√			
T02		√		
T03			√	√

Unit	Course Contents	Student Engagement Activity
<b>Unit - I</b>	<b>Team Management</b> <ul style="list-style-type: none"> <li>● Team communication &amp; team conflict resolution</li> <li>● Role of a team leader</li> <li>● Team goal setting &amp; understanding team development</li> <li>● Team dynamics &amp; multicultural team activity</li> <li>● Johari Window Model</li> </ul>	Collaborative Working Game Activity
<b>Unit-II</b>	<b>Time Management</b> <ul style="list-style-type: none"> <li>● Time management matrix</li> <li>● Pareto Principle (80/20 rule)</li> <li>● Development process of plan of action</li> </ul>	What You Did Yesterday Activity
<b>Unit-III</b>	<b>Leadership</b> <ul style="list-style-type: none"> <li>● Difference between leadership &amp; management</li> <li>● Types of leadership style</li> <li>● Core leadership skills</li> </ul>	Lead The Blindfolded Activity
<b>Unit-IV</b>	<b>Stress Management</b> <ul style="list-style-type: none"> <li>● Sign of stress &amp; its impact</li> <li>● Types of stress</li> <li>● Techniques of handling stress</li> </ul>	Keeping Cool Activity
<b>Unit - V</b>	<b>Emotional Intelligence</b> <ul style="list-style-type: none"> <li>● Emotional intelligence &amp; emotional competence</li> <li>● Components &amp; behavioral skills of emotional intelligence</li> </ul>	Guess The Emotion Game Activity
<b>Unit - VI</b>	<b>Critical Thinking</b> <ul style="list-style-type: none"> <li>● Types of thinking &amp; Characteristics</li> <li>● Critical thinking standards</li> <li>● Barriers to critical thinking</li> </ul>	Think Pair Share Activity

Learning Resources	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

### Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

**Internal (Continuous Assessment & Evaluation) & End Term  
(Assessment & Evaluation) for Teamwork &  
Interpersonal Skills**

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Team Management	Role Play / Group Activity	10	Written Test	10
II	Time Management		10		
III	Leadership		10		
IV	Stress Management	Assignment	10	Viva	20
V	Emotional Intelligence	Written Test	10		
VI	Critical Thinking		20		

**SEMESTER - V**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>3 / 5</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS553</b>	<b>Course Title</b>	<b>Presentation Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO):-**

1. To develop the public speaking skills of the student.
2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
3. To make the students learn to speak in a debate session by putting his arguments and making others accept his viewpoint convincingly.

**Training Learning Outcomes (TLO): -**

After the completion of the training, the student will have ability:

1. To be confident in presenting himself in front of an audience.
2. To become professional in his approach towards work culture.
3. To enhance the level of communication skills while interacting with others.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>			
<b>Training Learning Outcomes (TLO) Training Objectives(TO)</b>	TLO1	TLO2	TLO3
T01	√	√	
T02		√	
T03		√	√

<b>Unit</b>	<b>Course Contents</b>	<b>Student Engagement Activity</b>
<b>Unit-I</b>	<b>Importance of Presentation Skills</b> <ul style="list-style-type: none"> <li>● 4 P's of presentation skills – plan, prepare, practice &amp; present</li> <li>● Guidelines for effective presentation</li> </ul>	PPT Presentation Activity
<b>Unit-II</b>	<b>Storytelling Skills</b> <ul style="list-style-type: none"> <li>● 4 P's of storytelling skills – people, place, plot &amp; purpose</li> <li>● Types of storytelling techniques</li> <li>● Importance of storytelling skills</li> </ul>	Start From Where I Stopped Activity

<b>Unit-III</b>	<b>Corporate Culture Etiquettes</b> <ul style="list-style-type: none"> <li>● Importance of professional behavior at work place</li> <li>● Understand &amp; implementation of etiquettes at work place</li> <li>● Importance of values &amp; ethics</li> <li>● Types of professional / corporate etiquettes</li> </ul>	Etiquettes Role Play Activity
<b>Unit-IV</b>	<b>Debate / Extempore</b> <ul style="list-style-type: none"> <li>● Difference between debate, extempore &amp; group discussion</li> <li>● Learning argument /counter argument in debate</li> </ul>	Current Affair Topic Speech Activity
<b>Unit-V</b>	<b>Art of Creating Impression</b> <ul style="list-style-type: none"> <li>● Importance of creating first impression</li> <li>● 6 ways to master the art of creating impression</li> </ul>	Speech Activity
<b>Unit-VI</b>	<b>Problem Solving</b> <ul style="list-style-type: none"> <li>● Types of problems &amp; its solutions</li> </ul> Problem solving process & tools	Think Pair Share Activity

<b>Learning Resources</b>	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

### Pedagogy

1. The training will be based on the concept of learning by practice.
2. The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student engagement in training activities.
3. The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Presentation Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Importance of Presentation Skills	Presentation Activity	20	Written Test	10
II	Storytelling Skills	Speech Activity	15		
III	Corporate Culture Etiquettes	Assignment	10		
IV	Debate/Extempore	Speech Activity / Written Activity	15	Viva	20
V	Art of Creating Impression		10		
VI	Problem Solving				

**SEMESTER - VI**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>3 / 6</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23SS654</b>	<b>Course Title</b>	<b>Professional Skills</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

1. To encourage students to learn and apply effective writing skills.
2. To make the students learn various types of business correspondence letters, cover letters & resume.
3. To encourage students to learn how to talk and convince people in GD & interview.
4. To make the students learn to build rapport for building positive relationships professionally at the workplace.

**Training Learning Outcomes (TLO): -**

After the completion of the training, the student will have ability:

1. To understand the importance of professional writing required in workplace.
2. To explore different formats in resume, cover letters & other business related letters.
3. To develop knowledge, skills and understanding people in-group and individually.
4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>Mapping Matrix of Training Objectives (TO) &amp; Training Learning Outcomes (TLO)</b>				
<b>Training Learning Outcomes (TLO) ⊕ Training Objectives(TO)△</b>	TLO1	TLO2	TLO3	TLO4
T01	√			
T02	√	√		
T03		√	√	√
T04.			√	√

Unit	Course Contents	Student Engagement Activity
Unit-I	<b>Email Writing</b> <ul style="list-style-type: none"> <li>● Importance of email communication skills</li> <li>● Basic rules of effective email writing</li> <li>● Structure of email – address, subject, message text, attachments, signature</li> </ul>	Email Practice Activity
Unit-II	<b>Resume Writing</b> <ul style="list-style-type: none"> <li>● Difference between Resume, CV &amp; Bio data</li> <li>● Guidelines of resume writing</li> <li>● Resume preparation of the student</li> </ul>	Resume Making Activity
Unit-III	<b>Letter Writing</b> <ul style="list-style-type: none"> <li>● Types of Letter Writing – Application, Leave, etc.</li> <li>● Cover letter</li> </ul>	Letter Writing Activity
Unit-IV	<b>Group Discussion (GD)</b> <ul style="list-style-type: none"> <li>● Characteristics of GD &amp; subject knowledge</li> <li>● Do's &amp; Don'ts in GD</li> <li>● Strategies of GD</li> <li>● Types of GD</li> </ul>	Group Discussion Practice Activity
Unit-V	<b>Interview Skills</b> <ul style="list-style-type: none"> <li>● Preparation of the interview &amp; company details information</li> <li>● Do's &amp; Don'ts in interview</li> <li>● Types of Interviews</li> </ul> Strategies of interview	Mock Interview Practice Activity
Unit-VI	<b>Negotiation Skills</b> <ul style="list-style-type: none"> <li>● Importance of negotiation skills</li> <li>● Four phases of negotiation skills</li> <li>● Barriers to negotiation &amp; overcoming it</li> </ul> Win-win negotiation	Win-Win Activity

Learning Resources	
<b>Text Book</b>	<i>Communication Skills</i> by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
<b>Suggested Reference Book</b>	<i>Personality Development &amp; Communication Skills-1</i> by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

### Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

### Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Professional Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Email Writing	Written Assignment	10	Written Test	10
II	Resume Writing		10		
III	Letter Writing		10		
IV	Group Discussion	Group Discussion Activity	15	Viva	20
V	Interview Skills	Mock Interview Activity	15		
VI	Negotiation Skills	Role Play	10		

**SEMESTER - VII**

<b>Department Of Training &amp; Placement</b>			
<b>Training Cell</b>			
<b>Programme</b>	<b>Faculty of Engineering &amp; Technology</b>		
<b>Year / Semester</b>	<b>4 / 7</b>	<b>Course Category</b>	<b>SEC</b>
<b>Course Code</b>	<b>23AR755</b>	<b>Course Title</b>	<b>Aptitude &amp; Reasoning</b>
<b>Continuous Evaluation: 70</b>		<b>End Term Examination: 30</b>	
<b>Prerequisite: Nil</b>		<b>L T P: 0 0 2</b>	<b>Credits: 1</b>

**Training Objectives (TO): -**

1. To understand the basic concepts of quantitative ability and logical reasoning.
2. To make students practice on the concepts of quantitative ability and logical reasoning.
3. To prepare the students for aptitude and reasoning round in placement selection process & other competitive exams.

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

1. To understand the basic concepts of quantitative ability.
2. To solve campus placements aptitude papers covering Quantitative Ability.
3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
T01	√		
T02		√	
T03			√

**COURSE CONTENTS****A-Quantitative Ability****UNIT - I**

- Number System
- Percentage
- Profit, Loss and Discount
- Simple Interest and Compound Interest

**UNIT - II**

- Allegation and Mixture
- Average
- Ratio, Proportion and Variation, Problem on Ages and Numbers
- Time and Work
- Time, Speed and Distance

**UNIT - III**

- Permutation and Combination

- Probability
- Data Interpretation
- Geometry and Menstruations
- Sequence, Series & Progression and Logarithmic

### B- Logical Reasoning

#### UNIT - IV

- Number Series and Alphabet Series
- Direction Sense Test
- Coding -Decoding
- Blood Relation

#### UNIT - V

- Syllogism
- Dice, Cube and Cuboids
- Seating Arrangement

#### UNIT - VI

- Clock and Calendar
- Critical Reasoning
- Order and Ranking, Ven diagram, Analogy

Learning Resources	
<b>Text Books</b>	<b><i>Quantitative Aptitude for Competitive Examinations</i></b> by R S Aggarwal: S Chand Publishing, 2022.
	<b><i>A Modern Approach to Logical Reasoning</i></b> by R S Aggarwal: S Chand Publishing, 2022.

#### Pedagogy-

- The training will be based on the concept of learning by doing and practice.
- The training will involve 50% of the training time on teaching the concepts and the remaining 50% will be focusing on practice.
- The training will follow a circular approach where students are taught, evaluated and given the feedback.

**Internal (Continuous Assessment & Evaluation) & End Term  
(Assessment & Evaluation) for Aptitude &  
Reasoning**

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Quantitative Ability	Written Assignment	10	Written Test	30
II			10		
III			10		
IV	Logical Reasoning		15		
V			15		
VI			10		