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. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY

SRM UNIVERSITY DELHI-NCR, SONEPAT

39, Rajiv Gandhi Education City, Sonepat
Haryana-131029

SRM UNIVERSITY
DELHI-NCR, SONEPAT

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 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 UNIVERISTY 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 inner quest to learn, unlearn and relearn.

MAPPING OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES

AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES	**FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES**
Advancement to a professional position by virtue of their knowledge, skills and attitude.	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 2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
Recognition for solving engineering problems and developing design solutions that consider safety and sustainability	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
Work as successful professionals in diverse engineering disciplines	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;
Increasing responsibilities of technical and managerial leadership in their work organizations;	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;
Professional development through a commitment to career-long learning.	6. an understanding of professional and ethical responsibility; 7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

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

(TABULAR FORMAT)

MAPPING	FEPELO1	FEPLO2	FEPLO3	FEPLO4	FEPLO5	FEPLO6	FEPLO7
FEPEO1	√	√					
FEPEO2		√	√				
FEPEO3			√	√			
FEPEO4				√	√	√	
FEPEO5						√	√

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 group:** 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 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) 0– 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 problem solving attitude that prepares them to productively engage in research and higher learning.

PEO2. To build 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 academic environment that enables them to understand the significance of life-long learning in varied situations and teams in 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 instil communication and management skill that generates 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 comprehended 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.

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	PLO10	PLO11	PLO12
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 earn 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 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 3rd semester to 6th 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 3rd Semester to 7th semester).

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

Live Projects is being introduced for all Engineering disciplines from 5th semester - 7th 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 live project as an internship project. In that case, the student will be monitored on 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 presentation to keep a check on the progress of Student.

- A student may also create 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):

- Student's will be monitored on 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 are 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	
Basic Applied Sciences	BAS		7
Engineering Sciences	ES		10
Professional Core	PC		14
Professional Electives -Program Specific Specialized Elective Courses	PE		11
Ability Enhancement Courses	AEC		4
Skill Enhancement courses (Technical and Soft skills)	SEC	Technical Skills	4
		Soft Skills	5
Value Added Courses	VAC		3
Practical / Workshop	P/W		9
Live Project & Industrial Visit and Summer Internship	LP /SI	Live Project and Industrial Visit	5^{th} -7^{th} Semester 3
		Minor Project	7^{th} Semester 1
		Major Project	8^{th} Semester 1
Multidisciplinary courses (Humanities and Social Sciences)(HSS)	MDC		3
TOTAL			**75**

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
TOTAL		**25**	**22**	**23**	**25**	**24**	**25**	**24**	**12**	**180**	100.0

COURSE CURRICULUM BACHELOR OF TECHNOLOGY
(COMPUTER SCIENCE AND ENGINEERING)MDEGREE COURSE
TABLE 5: PROGRAMME COURSES C R E D I T SRUCTURE SEMESTER WISE

SEMESTER-I

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
THEORY								
1	24AS101	(BAS)	Engineering Mathematics-I	3	1	0	4	4
2	24AS102/ 24AS103	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE101/ 24EC101	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME101/ 23CS101	(ES)	Engineering Mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS101	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx101/ 24FLGR 101-I/ 24FLFR101-I	(AEC)	Hindi-I/German-I/French-I	2	0	0	2	2
7	23ESEB101/ 23VAC102	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/18**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS152/24AS153	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE151/24EC151	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME151/23 CS151	(ES)	Basic Mechanical Engineering Lab/ C Programming Lab	0	0	2	2	1
11	23ME152/23ME153	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS151*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/10**	**8/10**	**4/5**
TOTAL CREDITS (THEORY + PRACTICAL)				**16/18**	**2**	**8/10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM101- INDUSTRIAL SESSION – I will be offered to IBM Specialization students.

[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 Hour s	
THEORY								
1	24AS201	(BAS)	Engineering Mathematics-II	3	1	0	4	4
2	24AS202/ 24AS203	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE201/ 24EC201	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME201/ 23CS201	(ES)	Engineering mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS201	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx201/ 24FLGR 201-II/ 24FLFR201-II	(AEC)	Hindi-II/German-II/French-II	2	0	0	2	2
7	23ESEB201/2 3VAC 202	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/1 8**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS252/24AS253	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE251/ 24EC251	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME251/23CS25 1	(ES)	Basic Mechanical Engineering Lab/ C Programming Language Lab	0	0	2	2	1
11	23ME251/2 3ME252	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS251*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/10**	**8/10**	**4/5**
Total Credits (Theory + Practical)				**16/1 8**	**2**	**8/10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM201- INDUSTRIAL SESSION –II will be offered to IBM Specialization students.

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

SEMESTER – III

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

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)

SEMESTER – IV

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

***- Teaching Load**

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

SEMESTER – V

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL HOURS	
Theory							
24MDCXXX	Multidisciplinary Elective-II	MDC	3	0	0	3	3
24CSPE3001	Compiler Design	PC	3	1	0	4	4
23CSPExxx	Professional Elective -III	PE	3	1	0	4	4
23CSPExxx	Professional Elective -IV	PE	3	0	0	3	3
23CSPExxx	Professional Elective –V	PE	3	0	0	3	3
Total (Theory)			**15**	**2**	**0**	**17**	**17**
Practical							
23CSPE3113	Professional Elective -III Lab	PE	0	0	2	2	1
24CSPExxx	Compiler Design Lab	P	0	0	2	2	1
23CS0303A	Live Project-I &Industrial Training	LP**	0	0	2	2	1
24CS2115	Programming using MATLAB	PC	1	0	2	3	2
Total (Practical)			**1**	**0**	**8**	**9**	**5**
Skill Enhancement Course							
24CS0301A	Wearable Technology	SEC	0	0	2	2	1
23SS553	Presentation Skills	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**4**	**4**	**2**
Total (Theory + Practical+ Skill Enhancement)			**16**	**2**	**12**	**30**	**24**

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

SEMESTER – VI

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

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 current semester.**

SEMESTER – VII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL	
Theory							
24CS4003	Cloud Computing	PC	3	1	0	4	4
24CS4005	Web Application Development	PC	3	1	0	4	4
23CSPExxx	Professional Elective Course – VIII	PE	3	1	0	4	4
23CSPExxx	Professional Elective Course – IX	PE	3	1	0	4	4
Total (Theory)			**12**	**4**	**0**	**16**	**16**
Practical							
23CS4113	Cloud Computing Lab	P	0	0	2	2	1
23CS4115A	Live project-III & Industrial Training	LP**	0	0	2	2	1
23CS4117A	Minor Project	LP	0	0	10(8)	8	5
Total (Practical)			**0**	**0**	**12**	**12**	**7**
Skill Enhancement Course							
23AR755	Aptitude and Reasoning	SEC	0	0	2	2	1
Total (Skill Enhancement)			**0**	**0**	**2**	**2**	**1**
Total (Theory + Practical+ Skill Enhancement)			**12**	**4**	**14**	**30**	**24**

NOTE: ** To be evaluated in current semester.

SEMESTER – VIII

COURSE CODE	COURSE	CATEGORY	HOURS PER WEEK				CREDITS
			L	T	P	TOTAL	
23CS4114	Major Project	LP	0	0	24	24	12
Total (Theory + Practical+ Skill Enhancement)			0	0	24	24	12

* *To be monitored at the Institute Level*

***Teaching Load*

LIST OF ABILITY ENHANCEMENT COURSES

Course Code	Course	Category	L	T	P	Credits
23AEC101/23AEC151	Communicative English/ Communicative English Lab	AEC	2	0	2	3
23AEC102/ 23AEC103/ 23AEC104	Hindi-I/FRENCH-I/GERMAN-I	AEC	2	0	0	2
23AEC202/ 23AEC203/ 23AEC204	Hindi-II/ FRENCH-II/GERMAN-II	AEC	2	0	0	2

SKILL ENHANCEMENT COURSES (SEC)

Category	Course Code	Course Name	L	T	P	Credits
Technical Training						
SEC	24CS0201A/24CS0201B/24CS0201C/24CS0201D	Data Structure and Algorithms using C or C++/Industry Automation Level-I/ Digital Marketing/Fundamentals of CAD for Engineers	0	0	2	1
SEC	24CS0202A/24CS0202B/24CS0202C	Introduction to SPSS Tool/Design Thinking and Augmented Virtual Reality/Programming Using Python for Engineers	0	0	2	1
SEC	24CS0301A/24CS0301B/24CS0301C/24CS0301D/24CS0301E	Wearable Technology/Big Data Analytics, Tools and Techniques/Machine Learning using Python/Industry Automation Level-II/RCC Structure Drawing Training	0	0	2	1
SEC	24CS0302A/24CS0302B/24CS0302C/24CS0302D	Artificial Intelligence and Machine Learning/MATLAB for Engineers/ Structural Analysis using FEM-based Tools/Data Analytics Tools	0	0	2	1
SEC	24CS0401A/24CS0401B/24CS0401C/24CS0401D	Building information modeling/PLC Programming/ 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**
23MDC101/24MDC101A/24MDC101B/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

Note

1. These courses will be of introductory level and shall have 3 credits.
2. Student will not be allowed to choose or repeat the courses already gone through in class XII and present in Program core and specialization.
3. Student will have option to choose any 3 out of the pool.

*Course shall be based on applications, tools and techniques.

LIST OF PROFESSIONAL ELECTIVE COURSES
Specialization-I

Elective	Course Code	Course	Category	L	T	P	C
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	24CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4
III	24CSPE3003/ 24CSPE3113	Computer Networks / LAB	PE	3	0	2	4
IV / V	24CSPE3027	Optimization Techniques	PE	3	0	0	3
	24CSPE3035	Distributed Databases	PE	3	0	0	3
	23CSPE3019	Computer Graphics	PE	3	0	0	3
	24CSPE3021	System Modelling and Simulation	PE	3	0	0	3
	24CSPE3023	Digital Image Processing	PE	3	0	0	3
	24CSPE3033	Principles of Programming Languages	PE	3	0	0	3
VI/VII	**23CSPE3020**	**Distributed Operating System**	PE	3	1	0	4
	23CSPE3024	Software Project Management	PE	3	1	0	4
	24CSPE3026	Grid Computing	PE	3	1	0	4
	23CSPE3028	Object Oriented Analysis & Design	PE	3	1	0	4
	23CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	23CSPE3032	Cyber Security	PE	3	1	0	4
VIII /IX	**23CSPE4019**	**Network Security & Cryptography**	PE	3	1	0	4
	23CSPE4033	Software Testing	PE	3	1	0	4
	23CSPE4023	Wireless Adhoc and Sensor Network	PE	3	1	0	4
	23CSPE4035	Advanced Java Programming	PE	3	1	0	4
	23CSPE4037	NASSCOM Associate Analytics – II	PE	3	1	0	4
	23CSPE4025	Data Warehousing & Data Mining	PE	3	1	0	4
	23CSPE4029	Machine Learning Using R	PE	3	1	0	4

Specialization-II							
Elective	**Course Code**	**Course**	**Category**	**L**	**T**	**P**	**C**
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	24CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4
III	24CSPE3003/ 24CSPE3113	Computer Networks / LAB	PE	3	0	2	4
IV/V	23CSPE3025	Visual Programming	PE	3	0	0	3
	24CSPE3033	Principles of Programming Languages	PE	3	0	0	3
	23CSPE3039	Block Chain	PE	3	0	0	3
	23CSPE3037	Theory of App Development	PE	3	0	0	3
	24CSPE3041	Data Science	PE	3	0	0	3
	23CSPE3031	Soft Computing		3	0	0	3
VI/VII	23CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	23CSPE3032	Cyber Security	PE	3	1	0	4
	23CSPE3034	Design Thinking	PE	3	1	0	4
	23CSPE3036	Predictive Analytics	PE	3	1	0	4
	23CSPE3038	Business Intelligence	PE	3	1	0	4
	23CSPE3040	Internet of Things	PE	3	1	0	4
VIII/ IX	23CSPE4019	Network Security & Cryptography	PE	3	1	0	4
	23CSPE4027	Mobile Computing	PE	3	1	0	4
	23CSPE4029	Machine Learning Using R	PE	3	1	0	4
	23CSPE4031	Open Source Software	PE	3	1	0	4
	23CSPE4039	NASSCOM Associate Analytics – III	PE	3	1	0	4
	24CSPE4041	Advanced Internet of Things	PE	3	1	0	4
	23CSPE4047	Advanced Block Chain	PE	3	1	0	4

	Specialization-III						
Elective	**Course Code**	**Course**	**Category**	**L**	**T**	**P**	**C**
I	24CSPE2007	Computer Architecture & Organization	PE	3	1	0	4
II	23CSPE2008/ 24CSPE2118	Analysis and Design of Algorithms /LAB	PE	3	0	2	4
III	24CSPE3003/ 24CSPE3113	Computer Networks / LAB	PE	3	0	2	4
IV/ V	24CSPE3035	Distributed Databases	PE	3	0	0	3
	23CSPE3019	Computer Graphics	PE	3	0	0	3
	24CSPE3023	Digital Image Processing	PE	3	0	0	3
	24CSPE3033	Principles of Programming Languages	PE	3	0	0	3
	23CSPE3039	Block Chain	PE	3	0	0	3
	23CSPE3031	Soft Computing	PE	3	0	0	3
VI/ VII	23CSPE3020	Distributed Operating System	PE	3	1	0	4
	23CSPE3024	Software Project Management	PE	3	1	0	4
	23CSPE3028	Object Oriented Analysis & Design	PE	3	1	0	4
	23CSPE3030	Neural Networks & Fuzzy Logic	PE	3	1	0	4
	23CSPE3034	Design Thinking	PE	3	1	0	4
	23CSPE3038	Business Intelligence	PE	3	1	0	4
VIII /IX	23CSPE4019	Network Security & Cryptography	PE	3	1	0	4
	23CSPE4033	Software Testing	PE	3	1	0	4
	23CSPE4035	Advanced Java Programming	PE	3	1	0	4
	23CSPE4029	Machine Learning Using R	PE	3	1	0	4
	24CSPE4041	Advanced Internet of Things	PE	3	1	0	4
	23CSPE4047	Advanced Block Chain	PE	3	1	0	4

SEMESTER - I & SEMESTER – II

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite:12th Mathematics	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Matrices and its applications
2. To introduce the concept of Differentiation-Ordinary & Partial differentiation and their applications.
3. To understand the calculation of Multiple Integrals with their Applications.
4. To get the knowledge that illustrate the concepts of Vector Calculus to understand solenoidal and irrotational vectors with inter dependence of line, surface and volume integral.
5. To familiarize with the concept of sequence & series and their convergence.

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 to compute inverse, eigenvalues and eigenvectors.
2. Apply the knowledge of differentiation, partial differentiation, Maxima and minima of two variables for analyzing engineering problems.
3. Apply the multiple integrals in engineering applications.
4. Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stroke's theorems.
5. Demonstrate the convergence of sequence & series.

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

CLO / CO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

COURSE CONTENTS

Unit-1 : Matrices

Introduction, 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, Diagonalization of Matrices, Simple applications.

Unit – 2: Differentiation

Successive differentiation, nth order derivatives of standard functions, Leibnitz's theorem, 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.

Unit-3: Multiple Integral

Introduction, 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, Simple Applications of Multiple Integrals – Area (Cartesian Coordinates). Beta and Gamma functions and their properties.

Unit-4: Vector Calculus

Introduction, 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), Simple Applications.

Unit-5: Sequence and Series

Introduction, 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.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
2. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 6th Edition, Narosa Publishing House, 2019.
3. Kreyszig. E, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. Singapore, 2015.
4. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
5. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

Elementary Mathematics-I (For BME only)	
Course Code:24AS104	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Matrices and Determinants.
2. To introduce the concept of Differentiation.
3. To introduce the concept of Integration.
4. To get the knowledge that 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 computer science.
3. Apply the integrals in computer applications.
4. Understand the differential equations and their simple applications.

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-1: Matrices and determinants (6 Lectures)

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,

Unit-2: Differential Calculus (6 Lectures)

Introduction, Continuity, Differentiability-Chain Rule, Derivatives of implicit functions, Derivatives of Trigonometric functions and Inverse trigonometric functions, Derivatives of Exponential and Logarithmic functions.

Unit-3: Integral Calculus (6 Lectures)

Introduction, Elementary Properties, Integration by method of Substitution, Integration using trigonometric identities, Integration by Partial fractions, Integration by parts.

Definite Integrals, Properties, Evaluation of definite Integrals.

Unit-4: Ordinary Differential Equations (6 Lectures)

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.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
2. Jain R. K., Iyengar S. R. K., "Advanced Engineering Mathematics", 6th Edition, Narosa Publishing House, 2019.
3. Kreyszig. E, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. Singapore, 2015.
4. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
5. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

ELEMENTARY BIOLOGY (For BME only)	
Course Code: 24AS105	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 1 1 0	
Prerequisite: 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. Analyse 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 (CO) & COURSE LEARNING OUTCOMES (CLO)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES					
	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓					
CO2	✓	✓				
CO3		✓	✓			
CO4				✓	✓	
CO5				✓	✓	
CO6					✓	✓

COURSE CONTENTS:

UNIT I: NATURE OF LIVING THINGS

Definition of life, Miller's experiment, theories and evidences 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.

UNIT II: MOLECULAR ORGANIZATION OF CELL

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.

UNIT III: FUNDAMENTALS OF GENETICS

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.

UNIT IV: PHYSIOLOGY

Animal Physiology: Hormones and their mode of action, types of asexual and sexual reproduction, stages of embryogenesis.

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

ENGINEERING PHYSICS	
Course Code: 24AS102/24AS202	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To provide students with the knowledge of variety of important concepts of Physics and their applications in Engineering and Technology
2. To enhance the understanding of the concepts found in Mechanics, Harmonic Oscillations, wave Optics, Lasers, Fiber Optics.
3. To familiarize the quantum mechanical approach and its application in engineering.
4. To develop necessary understand on semiconductors and their applications in devices; Apply theory learnt to correlate with the environmental issues such as the use of solar cells

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. The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.
2. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
3. The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.
4. The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure to semiconductor devices such as solar cell.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES:

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
CO1	√	√	√	
CO2	√	√		
CO3			√	
CO4				√

COURSE CONTENTS

Unit- 1: Fundamentals: Newtonian mechanics, Moment of Inertia, Friction, Work-Power-Energy, Conservation Laws, Thermodynamic Laws, Electro-Magnetic Spectrum, Huygen wave theory, Intrinsic and Extrinsic semiconductors.

Unit-2: WAVES AND OSCILLATIONS:
Oscillations: Simple Harmonic Motion (SHM), Differential Equation of SHM and its Solutions, Conservation of Energy. Mass-string System. Damped Harmonic Oscillator-Overdamped, Critically Damped, Under Damped motions, Relaxation Time, Forced vibrations. Resonance & Quality Factor.

Unit-3 : ELECTROMAGNETIC THEORY AND FIBER OPTICS:
Mathematical Background: Gradient, Divergence, curl (Physical Significance), Irrotational & Solenoidal Field, Gauss Divergence and Stoke's Theorem, Maxwell's Equation in Integral & Differential forms. Wave equation for Electromagnetic (EM) Waves-Propagation in free space, Characteristic Impedance, Poynting theorem (only definition). **Fiber optics:** Structure of optical Fiber, Principle of propagation and numerical aperture, acceptance angle and classification of optical fiber (single mode and multimode).

Unit-4: OPTICS AND LASER:
Interference: Superposition Principle, Division of Amplitude-Interference in Thin Films, Application: Interference in Wedge shaped Film, Application: Newton's Ring. Diffraction: Fraunhoffer Vs Fresnel Diffractions, Fraunhoffer Diffraction in Single & Multiple slits/Grating, Resolving power & Dispersive power of grating and prism. Laser: Spontaneous and stimulated emission, Einstein's coefficients, Characteristics of laser, Ruby Laser.

Unit-5: STATISTICAL MECHANICS AND QUANTUM MECHANICS:
Qualitative treatment of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics**,** Black body problem, Photoelectric effect and Compton scattering (For concept), de Broglie Hypothesis of matter waves, de-Broglie waves-Phase & Group Velocities, Davison-Germer experiment, Uncertainty Principle, Application of Uncertainty Principle, Significance of Wave Functions, Postulates of Quantum Mechanics**,** Schrodinger equation-Time dependent and time independent equation Application: Particle in a box (1-D).

Unit-6 : SEMICONDUCTOR AND OPTOELECTRONIC DEVICES
Fermi level in intrinsic and extrinsic semiconductors, Effect of temperature and carrier concentration (qualitative), Direct and indirect bandgap semiconductor, LED, Photodiode, LDR, Photovoltaic effect, and Solar Cell. Hall Effect: Hall coefficient and its applications.

TEXT BOOKS

1. Beiser A, Concepts of Modern Physics, 5th Ed., McGraw Hill International, 2003.
2. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012.
3. David J. Griffiths, Introduction to Electrodynamics, Pearson Education Limited, London, 2015.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
6. Engineering Mechanics (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill

REFERENCE BOOKS

1. Arumugam, M., Engineering Physics, 2nd edition, Anuradha Publishers, KumbaKonam, 2003.
2. Gaur and Gupta, Engineering Physics, 7th edition, Dhandapani and Sons, New Delhi, 1997.
3. N. Subrahmanyam and Brij Lal, Waves and Oscillations.
4. David J. Griffiths, Introduction to Quantum Mechanics, Pearson Education Limited.

ENGINEERING CHEMISTRY	
Course Code: 24AS103 /24AS203	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. The knowledge of water quality parameters and the treatment of water.
2. Explain states of matter, phase diagram and related applications.
3. To learn various types of fuels and their properties, and to understand the basics of spectroscopy.
4. To understand the fundamental concepts of corrosion chemistry.
5. To learn an introductory idea about new materials.

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. Understand to identify the quality of water and how to improve the quality of water.
2. Explain states of matter, phase diagram, related applications and polymers.
3. Analyze the quantitative aspects of fuel combustion, spectroscopy
4. Explain the mechanism of corrosion.
5. Get preliminary understanding on introductory idea about nano materials.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES:

COURSE LEARNING OUTCOME / COURSE OBJECTIVES	**CLO 01**	**CLO 02**	**CLO 03**	**CLO 04**	**CLO 05**
CO 01	√				
CO 02		√			
CO 03			√		
CO 04				√	
CO 05					√

COURSE CONTENTS

Unit-0 : General Introduction: Importance and scope of Chemistry:
Atomic and molecular masses, mole concept and molar mass, percentage composition, redox reactions, Chemical and ionic equilibrium; Acid & bases.

Unit-1 : Water Technology -:
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.

Unit-2: The Phase rule:
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 component system-Eutectic, Pb-Ag system.
Polymer: Terminologies, Classification of polymer, Preparation of special polymer-Nylon 6, 6, Polyethylene, Polystyrene, Teflon, Polymethyl-methacrylate, Bakelite.

Unit-3 : Fuels:
Classification of fuels, calorific value. G.C.V. and N.C.V., Solid fuels, Analysis of coal. Liquid fuels: Classification of petroleum, refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers.

UV Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, effect of conjugation on chromophores.

Unit-4: Corrosion:
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.

Unit-5: New Materials:
Introduction to nanomaterials, classification (0D, 1D, 2D) with examples, size dependent properties, Top-down and Bottom-up approaches of nanomaterial synthesis. Introductory idea on synthesis of nanomaterials via green synthetic route.

TEXT BOOKS

1. Engineering Chemistry (NPTEL web-book) by B. L. Tembe, Kamaludddin and M. S. Krishan.
2. Fundamentals of Molecular Spectroscopy by Banwell, Tata McGraw Hill Education.
3. Textbook of nanoscience and Nanotechnology, McGraw Hill Education (India) Pvt. Ltd., 2012.
4. Engineering Chemistry by Jain and Jain, DhanpatRai Publication.
5. Engineering Chemistry by Prasanta Rath, Cenage Learning India Private Ltd., 2015.
6. A text book of Engineering Chemistry by Shashi Chawla, DhanpatRai& Co. 2020
7. Inorganic Chemistry by Donald A. Tarr, 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 Univesity Press, 6th edition.
2. Advanced Engineering Chemistry by M. R. Senapati, University Science Press, India.
3. A Text book of Engineering Chemistry by S.S. Dara, 10th Edition, S. Chand & Company Ltd., NewDelhi, 2003

BASIC ELECTRICAL ENGINEERING	
Course Code: 24EE101/24EE201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electrical Engineering.

1. Students will gain knowledge regarding the various laws and principles associated with electrical systems.
2. Students will gain knowledge regarding electrical machines and apply them to practical problems.
3. Students will acquire knowledge in using the concepts in the field of electrical engineering.

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. To explain the strong basics of electrical engineering and practical implementation of electrical fundamentals.
2. To identify different applications of commonly used electrical machinery.
3. To define various renewable resources available in the power generation.
4. To understand the basic concept of a poly-phase system.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

Course Objectives	CLO1	CLO2	CLO 3	CLO4
CO1	√			
CO2			√	
CO3		√	√	√

COURSE CONTENTS

Unit-1: DC CIRCUITS AND ELECTROMAGNETISM (8 Hrs.)

Ohm's Law and Kirchhoff's Laws, Analysis of Series, parallel, and series-parallel circuits excited by independent voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem. Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance, and coefficient of coupling; Energy stored in magnetic fields

Unit-2: Single Phase A.C. Circuits:

Sinusoidal signal, instantaneous and peak values, RMS and average values, crest and peak factor, Concept of phase, representation-polar & rectangular, exponential and trigonometric forms, Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits.

Unit-3: Transformers:

Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency, and voltage regulation.

Poly-phase System*:*

Advantages of 3-phase system, Generation of 3-phase voltages, Voltage, current, and power in a star and delta connected systems, 3-phase balancedand unbalanced circuits, Power measurement in 3-phase circuits.

Unit-4: Three-Phase Induction Motors:

Concept of rotating magnetic field; Principle of operation, types and constructional features, Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Unit-5: Renewable Sources:

Sources of Electrical Power, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation, Introduction to Earthing

TEXT BOOKS

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

REFERENCE BOOKS

1. Kothari D P and Nagrath I **J,** "Basic Electrical Engineering ", Tata McGraw Hill, 1991

BASIC ELECTRONICS ENGINEERING	
Course Code: 24EC101/24EC201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To impart the knowledge of the passive and active electronic components
2. To understand the basic characteristics of Field Effect Transistors
3. To introduce the MOS devices
4. To gain knowledge of integrated circuit fabrication techniques
5. To introduce the digital logic gates and systems
6. To understand the principle of microprocessors

COURSE LEARNING OUTCOMES (CLOs)

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

1. To learn the fundamental concepts of semiconductor devices
2. An ability to apply the concept of diode in clipper and clamper circuits
3. Acquire the skills of constructing the different transistor configurations
4. To learn the basic concepts of integrated circuits
5. To Compile the different building blocks in digital electronics using logic gates and implement simple logic functions using basic universal gates
6. To acquire the knowledge of microprocessors.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6
I/II	24EC101/201	Basic Electronics Engineering	CO1	√	√				
			CO2		√	√			
			CO3			√	√		
			CO4			√	√		
			CO5					√	
			CO6						√

COURSE CONTENTS

Unit – 1: Semiconductor Diodes and Applications: p-n junction diode, Characteristics and Parameters, Half-wave rectifier, Full-wave rectifier, center tap and Bridge rectifier, and clipper, clamper, Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator and Numerical examples as applicable.

Unit –2: Bipolar Junction Transistor: Transistor Operation, Current Equation in n-p-n & amplifier; p-n-p transistors, CB, CE, CC Configurations and their Characteristics, Load line Analysis, BJT as Switch and amplifier, DC Biasing (Fixed bias and Voltage Divider), stability Factor.

Unit –3: Field Effect Transistor: JFET-types and their parameters, Operations, and their Characteristics, MOSFETs- types, Operations and their Characteristics, Secondary effects in MOSFET operation and Numerical.

Unit –4: Introduction to Operational Amplifiers: Ideal OPAMP, Inverting, and Non-Inverting OPAMP circuits, OPAMP applications: voltage follower, addition, subtraction, integration, differentiation; Numerical examples as applicable.

Unit –5: Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic Logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic, Logic Gates, Boolean algebra and Combinational Logic Circuits: Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table. Basic combinational logic circuits, Implementation of combinational logic, the universal properties of NAND and NOR gates, Half Adder adders, and full Adder.

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. Muthusubramanian.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

ENGINEERING MECHANICS	
Course Code: 23ME101/23ME201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To familiarize students with basic concepts of force and moments in equilibrium.
2. To impart students with the knowledge of mechanics for structural analysis.
3. To familiarize students with the centroids and MOI.
4. To make students aware of rigid body kinetics and kinematics.
5. To acquaint students with mechanics of deformable bodies.

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 concepts of force and moments in equilibrium.
2. Apply principles of mechanics to real engineering problems.
3. Understand the basics of Centroids and MOI.
4. Grasp the elements of rigid body kinematics and kinetics.
5. Understand the mechanics of deformable bodies.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
I/II	23ME101/201	ENGINEERING MECHANICS	CO1	√				
			CO2		√			
			CO3			√		
			CO4				√	
			CO5					√

COURSE CONTENTS

UNIT-I FORCE SYSTEMS:

• Basic concepts: Definitions, Basic assumptions, Scalar & Vector quantities, Free, Forced and fixed vectors.

• Force System: Force, Classification & Representation, Force as a Vector, Composition of forces, Parallelogram Law, Resolution, Principle of Transmissibility of forces

• Moment of a force, Vector representation, Moment for coplanar force system, Varignon's theorem

• Couple, Vector representation, Resolution of a force into a force and a couple.

• Force Systems: Coplanar Concurrent Force system and Coplanar Non-Concurrent force systems, Resultant of coplanar force system.

• Equilibrium of coplanar force system, Free body diagrams, Determination of reactions, Equilibrium of a body under three forces, Lami's theorem.

FRICTION:

• Introduction, Wet and Dry friction, Theory of Dry friction, Angle of friction, Angle of Repose, Cone of friction, Coulomb's laws of friction.

UNIT –II: BASIC STRUCTURAL ANALYSIS

• Plane Truss, Difference between truss and frame, Perfect and imperfect truss, Assumptions and Analysis of Plane Truss, Method of joints, Method of section, Zero force members.

UNIT –III- CENTROID AND MOMENT OF INERTIA:

• Center of Gravity, Center of Mass and Centroid of curves, areas, volumes, Determination of centroid by integration, Centroid of composite bodies.

• Definition of Moment of inertia of area, Perpendicular axis theorem and Polar moment of Inertia, Parallel axis theorem, Moment of inertia of simple areas by integration, Moment of Inertia of Composite Areas.

• Moment of Inertia of masses, Parallel axis theorem for mass moment of inertia, Mass moment of inertia of simple bodies by integration, Mass moment of inertia of composite bodies.

UNIT –IV- KINEMATICS OF RIGID BODY:

• Introduction, Absolute motion, Plane rectilinear motion of rigid body, Plane curvilinear Motion of rigid body, x-y and n-t components, Rotation of rigid bodies, Relative Motion, Plane Motion of rigid bodies, Instantaneous center of zero velocity

UNIT- V - KINETICS OF RIGID BODY:

• Introduction, Force, Mass and Acceleration, Newton's law of motion, D'Alembert's Principles and Dynamic Equilibrium, Laws of motion applied to planar translation, rotation and plane motion.

• Work and Energy, Kinetic energy, Principle of work and energy, Conservative forces, Law of conservation of energy,

• Linear Impulse and Momentum, Conservation of linear momentum.

TEXT BOOKS

1. Engineering Mechanics : Statics and Dynamics", R. C. Hibbler, Pearson
2. Engineering Mechanics " , Thimoshenko & Young , 4ed, Tata McGraw Hill
3. Engineering Mechanics : Statics and Dynamics", Shames and Rao, Pearson
4. Engineering Mechanics " , Bhavikatti , New Age

FUNDAMENTALS OF COMPUTER & C PROGRAMMING	
Course Code: 23CS101/23CS201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: 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 analyse 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's that help in developing of 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 (CO) and Course Learning Outcomes (CLO)

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO5	CLO6
CO1	√	√				
CO2		√	√			
CO3			√	√		
CO4					√	
CO5						√

COURSE CONTENTS

UNIT-1: INTRODUCTION OF COMPUTER SYSTEM

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.

UNIT-2: INTRODUCTION TO SYSTEM SOFTWARE

Programming language- Definition, types; Syntax & Semantics, Type of programming errors, Assembler, Linker, Loader, Compiler, Interpreter, debuggers, Algorithms, flowcharts and their symbols.

UNIT-3 : BASICS OF 'C' LANGUAGE

C Fundamentals, Basic data types, variables and scope, operators and expressions, formatted input/ output, expressions, selection statements, loops and their applications.

UNIT-4: ARRAY & FUNCTION

Arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications. Storage Classes and Pre-processor Directives.

UNIT-5 : STRUCTURE & FILE SYSTEM

Structures, Declaring a Structure, Accessing Structure Elements, Storing Structure elements, Array of Structures, Unions and Enumerations.

File Input/Output, Data Organization, File Operations, Opening a File, Reading from a File, Closing the File, Writing to a File, File Opening Modes.

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, 2010, New Delhi.
4. Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
5. Computer Fundamentals and Programming in C, Reema Theraja, Oxford

REFERENCE BOOKS

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

COMMUNICATIVE ENGLISH	
Course Code: 24HS101/24HS201	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

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 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 (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 & COURSE LEARNING OUTCOMES

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					✓

COURE CONTENTS

Unit-I: Introduction to Communication

- 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, Collocations and Punctuations

Unit-II: Workplace Communication

- Communication Challenges in 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 Power Point Presentation.

Unit-III: Effective Writing

- 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 with respect to technical writing

Unit-IV: Business Writing at Work

- Cover Letters and Applications
- Writing notices and circulars
- Email Writing and Memorandum
- Writing reports

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.

HINDI -I	
Course Code: 24HIN-101- I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

Course Description:
विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिन्दी विषय का पाठ्यक्रम तैयार किया है। हिन्दी विषय के प्रश्न पत्र की सामग्री में ज्ञान तथा शिक्षा के बदलते परिदृश्य को ध्यान में रखा गया है। हिन्दी के भक्तिकाल, रीतिकाल और आधुनिक काल 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, भाषायी क्षमता एवम् अभिवृद्धि भी इस पाठ्यक्रम का लक्ष्य है।

(Course Content)

(Unit-A)

इस इकाई में हिंदी भक्तिकाल के प्रमुख कवि कबीरदास हैं।

कबीरदास- कबीरदास के दोहे (5 दोहे)

(Unit-B)

इस इकाई में हिंदी रीतिकाल के प्रमुख कवि बिहारीलाल हैं।

बिहारीलाल – दोहे (5 **दोहे)**

(Unit-C)

इस इकाई में हिंदी आधुनिक काल के प्रमुख कवि माखनलाल चतुर्वेदी हैं।

माखनलाल चतुर्वेदी- पुष्प की अभिलाषा (कविता)

(Unit-D)

यह इकाई संचार कौशल से सम्बन्धित है. इसमें

(i) हिंदी के प्रमुख मुहावरे और लोकोक्तियाँ

(ii) आत्म परिचय (self-introduction), साक्षात्कार कौशल (interview skills), कार्यक्रम संचालन/मंच प्रबंधन (event management)

Course Outcomes:-

पाठ्यक्रम परिणाम

(1.Knowledge Outcome)

1. ज्ञान का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिन्दी क़े प्रमुख कवि जो पाठ्यक्रम में शामिल है, उनकी कविताओं की व्याख्या और काव्यगत विशेषताओं को छात्र समझेंगे ।

- छात्रों को काव्य में रस, अलंकार और छन्द का ज्ञान प्राप्त होगा|

-व्याकरण के अध्ययन से छात्रों को भाषा बोलने, लिखने और प पढने में सहायता प्राप्त होगी।

(2.Skill Outcome)

कौशल का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिंदी कवियों व उनकी कविताओं से परिचित हो जाएंगे।

- छात्र दोहे और कविता समझने में सक्षम होंगे।

-व्याकरण के ज्ञान के साथ -साथ शब्दों के उच्चारण के बोध से अवगत होंगे।

(Methodology)

(पद्धति)

- कक्षा व्याख्यान
-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।
(Required Books and Materials)
आवश्यक पुस्तकें और सामग्री
-कबीर ग्रन्थावली, संपादक-श्यामसुन्दर दास, काशी नागरी प्रचारिणी सभा।
- बिहारी सतसई, साहित्य संस्थान प्रयाग।
-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद।
-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन दिल्ली।

HINDI-II	
Course Code:24HIN201-II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

LAGHU KATHAEN AUR SANCHAR KAUSHAL

Course Description:

विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिंदी विषय का पाठ्यक्रम तैयार किया है | हिंदी विषय के प्रश्न पत्र 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 कल्पना शक्ति के विकास के साथ-साथ मनोरंजन भी होता है| संचार कौशल में मुहावरे, लोकोक्तियां, पत्र लेखन 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 सिध्द करती है |

Course Content

(Unit-A)

इस इकाई में हिंदी लघु कथाओं का संक्षिप्त परिचय दिया गया है –

1 हिंदी लघु कथा का सामान्य परिचय |

2 हिंदी लघु कथा के प्रमुख प्रकार |

(Unit-B)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 अंगूर की बेल

2. किसान और ठग

(Unit-C)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 बुराई का फल

2 चार विद्वान ब्राह्मण

(Unit-D)

यह इकाई संचार कौशल से सम्बंधित है, इसमें

(i) प्रेस रिपोर्ट, विज्ञापन, अनुवाद

(ii) **हिंदी पत्र लेखन और अपठित गद्यांश को समझना व तर्कसंगत उत्तर देना अपेक्षित है|**

(Course Outcome)

पाठ्यक्रम परिणाम

(1.Knowledge Outcome)

1 ज्ञान का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

हिंदी लघु कथाओं के मूल उद्देश्य को समझने में विद्यार्थी निपुण हो जाएंगे| लघु कथाओं 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)

2 कौशल का परिणाम

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

-पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिंदी लघु कथाओं से मनोरंजन भी होगा |

-विद्यार्थी लघु कथाओं के मूल कथ्य को समझेंगे|

-विचार तत्व के बोध से अवगत होंगे|
-हिंदी में पत्र लेखन और अपठित गद्यांश को समझने में सक्षम होंगे |

(**Methodology)**

(पध्दति)

- कक्षा व्याख्यान

-व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा|

-समय-समय पर छात्रों को प्रदत्त कार्य दिया जाएगा|

-दैनिक प्रश्नावली|

(Required Books and Materials)

आवश्यक पुस्तकें और सामग्री

-पाठ्यक्रम में निर्धारित लघु कथाओं का संकलन |

-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद |

-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन

GERMAN-I	
Course Code: 24FLGR101- I	**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 develop an ability for discussions, debates, research ventures, etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositionsin legal contexts.

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.

COURSE LEARNING OUTCOMES (CLOs):

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

1. Read and write short, simple texts.
2. Have Fluency in reading and writing.
3. Understand the dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. Know the culture of the countries where the German language is spoken.

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

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT 1

- Information über Deutschland
- Buchstaben, Regeln der Aussprache, Wochentage, Monate
- Grüße, sich vorstellen, Einige nützliche Ausdrücke des Alltagslebens, Zahlen bis 100

UNIT 2

- Zahlen, Über Personen sprechen (Name, Herkunft, Adresse, Telefonnummer, Alter, Beruf, Familie)
- Länder und Städte, Sprachen, Berufe, Bezeichnungen für Personen, Familienmitglieder
- Personalpronomen, Konjugation von Verben (heißen, wohnen, kommen, machen,lernen, arbeiten, studieren, sein)

UNIT 3

- Nomen (Genus, Singular-Plural), Bestimmter Artikel, Unbestimmter Artikel, Negation, W-Frage, Ja-Nein-Frage
- Über Sachen sprechen
- Sachen des Alltagslebens, Haushaltswaren, Adjektive, Gegenteile
- Satz Struktur

UNIT 4

- Akkusativ, Artikel und Personalpronomen im Akkusativ, Verben und Präpositionen mit Akkusativ,Konjugation und Verwendung von Verben (haben, kaufen, sehen, lieben, lesen, kennen, hören, verstehen, usw.)
- Kleidung, Farben, Wetter, Lebensmittel

TEXT BOOKS:

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)
  Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach Grammatik." *Übungsgrammatik Deutsch A1 bis B* 1 (2012): 329-330.Einfach Gramatik, Paul Rusch
- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." *Die Unterrichtspraxis/Teaching German* 44.1 (2011): 46-49.
- Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. *Tangram: Deutsch als Fremdsprache. Lehrerbuch*. Vol. 1. Hueber Verlag, 1998.
- Wolfgang Hieber: Lernziel Deutsch, Teil 1,Max HueberVerlag, 1984.

WEBSITE PAGES:

- https://www.nthuleen.com/teach.html

FRENCH-I	
Course Code: 24FLFR101-I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Basics of English Language	

COURSE OBJECTIVE (COs)

1. To develop **listening, speaking, reading, and writing** requisites of a language.
2. To develop the ability **to construct sentences** and **frame questions**.
3. To equip the students with **cultural elements and communication strategies** that will help them **communicate in varied situations.**
4. To familiarize the students with the **French and Francophone culture.**

COURSE LEARNING OUTCOMES (CLOs)

1. After completion of this course, the student will be able **to express and interact in French** used in daily conversations.
2. The student will be able **to write short and simple texts.**
3. The student will be able to **initiate, understand and respond to the queries of cultural significance in various settings.**
4. The student can demonstrate **knowledge and understanding** of French and Francophone culture.

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

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	**La Salutation et l'Introduction**	Saluer. Entrer en Contact. S'Excuser. Remercier. Se Présenter/Présenter Quelqu'un.	Les Pronoms Personnels Sujets. L'Alphabet. Les Articles Indéfinis. Les Verbes en -ER au Présent.	Salutations, Les Nombres. Les Objets de la Classe. La Nationalité.
2	**On Partage des Renseignements**	Demander de Se Présenter. Donner des Renseignements Personnels.	Etre et Avoir au Présent. Les Verbes en -ER au Présent. Les Adjectifs de Nationalités. L'Interrogation.	Les Adjectifs de Nationalité, Métiers et Secteurs Professionnels, L'Expression des Goûts et Intérêts
3	**Ma Ville et Mon Quartier**	Décrire et Qualifier une Ville ou un Quartier. Localiser. Demander et Donner la Directions.	Le Verbe Vivre. Les Articles Définis. Il y a/ Il n'y a pas. Les Prépositions. Les Adjectifs Qualificatifs. L'Impératif.	Les Prépositions de Localisation. Le Lexique des Sites. Etablissements et Service d'une Ville.
4	**Mes Intérêts et Goûts**	Parler de Ses Goûts et de Ses Loisirs. Donner Son Impression sur le Caractère de Quelqu'un.	Le Présent des Verbes en -ER, et du Verbe Faire. La Négation, Les Adjectifs Possessifs.	Avoir l'air. Loisirs. L'Expression des Goûts. Faire du/ de la. Ma Famille.

ENVIRONMENTAL BIOENGINEERING	
Course Code: 23ESEB101/23ESEB201	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: 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 COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**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 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. 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.

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, bio fertilizers, 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.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.

INDIAN CONSTITUTION & POLITY	
Course Code: 23VAC102/23VAC202	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: 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 (CO) and Course Learning Outcomes (CLOs)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	23VAC102/202	INDIAN CONSTITUTION & POLITY	CO1	√	√	√	
			CO2		√		√
			CO3			√	√
			CO4				√

COURSE CONTENTS

UNIT 1 DEMOCRACY, DIVERSITY AND THE CONSTITUTION:

- Concept of democracy and importance of right to vote
- Electoral Politics
- Concepts of diversity and discrimination on the grounds of gender, religion and caste
- Concept of democratic government
- Constitution design and salient features
- Preamble to the Constitution of India

UNIT 2 THE THREE WINGS OF THE STATE :

- The definition of State in Constitution of India
- Parliament, the State legislature and the making of laws
- Concept of cooperative federalism
- The Executive and Administration
- Role of Governor and the President of India
- The Judiciary

UNIT 3 LOCAL GOVERNMENT AND ADMINISTRATION:

- Panchayati Raj System
- Rural and Urban administration
- Social and Economic Justice for the marginalized
- Directive Principles of State Policy

UNIT 4 RIGHTS AND DUTIES:

- Fundamental Rights (Part III of the Constitution)
- Protection of Fundamental Rights – Writ petitions in High Court and Supreme Court of India
- Fundamental Duties
- The concept of Fraternity and secularism
- Public utilities and privatization

TEXT BOOKS:

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

REFERENCE BOOKS:

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

ENGINEERING PHYSICS LAB	
Course Code: 24AS152/24AS252	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

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. Apply the analytical techniques and graphical analysis to the experimental data

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. 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 (CO) and Course Learning Outcomes (CLOs)

Course Objectives	CLO 1	CLO 2	CLO 3
CO1	√	√	
CO2		√	
CO3			√

LIST OF EXPERIMENTS

(Students are required to complete/perform any 10 experiments from the list below)Experiment 1: To determine the moment of inertia of the disc and rigidity modulus of the wire by torsional pendulum.
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 gratingExperiment 4: To determine the attenuation, numerical aperture and acceptance angle of the given optical fiber.
Experiment 5: To study the resonance characteristics of LCR series circuit.
Experiment 6: To determine Planck's constant.
Experiment 7: To study the I-V characteristics of a PN junction diode. Experiment 8: To determine the energy band gap by four-probe method.
Experiment 9: To determine the Hall coefficient of the given n-type or p-type semiconductor.

Experiment 10: To study the solar cell characteristic.
Experiment 11: To determine the dispersive power of a given prism.
Experiment 12: To determine the width of a single slit by diffraction.
Experiment 13: To study the characteristic of LDR and finding the dark resistance.
Experiment 14: To determine the acceleration due to gravity by bar pendulum.
Experiment 15: To verify the laws of vibration of string using sonometer.
Experiment 16: To study the resonance characteristics of LCR parallel circuit

TEXT BOOKS

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

REFERENCE BOOKS

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

ENGINEERING CHEMISTRY LAB	
Course Code: 24AS153/24AS253	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

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 KMnO4 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 amount of sodium hydroxide and sodium carbonate in a mixture.
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 $KMnO_4$ and $K_2Cr_2O_7$.
13. Estimation of nickel in given sample solution
14. Estimation of nitrite in given sample solution.

BASIC ELECTRICAL ENGINEERING LAB	
Course Code: 23EE151/23EE251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

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 (CLO)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of 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 (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	23EE151/251	Basic Electrical Engineering Lab	CO1	√	√		√
			CO2	√			√
			CO3	√	√	√	√

COURSE CONTENTS

LIST OF EXPERIMENTS

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

1. To verify Kirchhoff'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.

BASIC ELECTRONICS ENGINEERING LAB	
Course Code: 24EC151/24EC251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To study the different types of electronic components and equipment
2. To observe the characteristics of electronic devices
3. To acquire the basic knowledge of digital logic levels and application of knowledge

COURSE LEARNING OUTCOMES (CLOs)

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

1. Measure the voltage, frequency, and phase of any waveform using CRO.
2. Generate sine, square, and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors, and operational amplifiers
4. To develop skills to build and verify digital circuits.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	24EC151/251	Basic Electronics Engineering Lab	CO1	√	√		
			CO2			√	
			CO3				√

LIST OF EXPERIMENTS

1. (a). To study active and passive electronic components and function generators.
   (b). To study the Digital Cathode Ray Oscilloscope (CRO) and operation of multi-meters.
2. Study of the V-I characteristics of P-N junction diode & Calculate DC & AC resistance.
3. Study of the V-I characteristics of Zener diode.
4. Construction of half-wave rectifier (with & without filter) and calculation of efficiency and ripple factor.
5. Construction of full wave rectifier circuits (with & without filter) and calculation of efficiency and ripple factor.
6. Design of inverting amplifiers using Op-Amp for a given gain with the help of a breadboard and distinct components.
7. Design of non-inverting amplifiers using Op-Amp for a given gain with the help of breadboard and distinct components.
8. Design of summer amplifiers using Op-Amp for a given gain with the help of a breadboard and distinct components.
9. Study of the input and output characteristics of Transistor.
10. Study and realization of digital logic gates with truth table verification

TEXT BOOKS

1. "Electronics Lab Manual", K.A. Navas ,Volume 1, Fifth Edition. 2015 by PHI Learning Private Limited, Delhi.

REFERENCE BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition

BASIC MECHANICAL ENGINEERING LAB	
Course Code: 23ME151/23ME251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To acquaint students with the laws of parallelogram and equilibrium of forces acting on anobject.
2. To make students understand the concepts and principles of friction.
3. To apply engineering sciences through learning-by-doing project work.
4. To provide a framework to encourage creativity and innovation. To develop team work and communication skills through group-based activity.

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 demonstrate:

1. The principle of equilibrium of forces and parallelogram.
2. The effects of friction on the motion.
3. The working and application of engineering components.
4. Develop group working, including task sub-division and integration of individual contributions from the team.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNINGOUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES			
	CLO1	CLO2	CLO3	CLO4
CO1			✓	
CO2	✓			
CO3				✓
CO4		✓		

LIST OF EXPERIMENTS

1. To verify the law of parallelogram of forces.
2. To study the equilibrium of a body under three forces.
3. To find reaction at the supports of a simply supported beam with different types of loading using Computation method.
4. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
5. To study functioning of belt pulley systems.
6. To find the coefficient of friction between belt and pulley using belt pulley system.
7. To find forces in members of a truss for different load conditions.
8. To determine the mass moment of inertia of a rotating disc
9. To find center of gravity of different geometrical objects using computation method.
10. To verify the law of conservation of energy.
11. Demonstration for centrifugal forces.
12. Engineering Design Project- Students in groups of 4/5 will do a project related to the course.

Note: At least ***8 experiments*** must be carried out.

TEXT BOOKS

1. Laboratory Manual

REFERENCE BOOKS

1. Strength of Materials. Thimoshenko & Young
2. Engineering Mechanics: Statics and Dynamics, R. C. Hibbler, Pearson
3. Mechanics of Solids, A. Mubeen, Pearson

C PROGRAMMING LAB	
Course Code: 23CS151/23CS251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: 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 real world.
5. Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
I/II	23CS151/ 251	C Programming Lab	CO1	√				
			CO2		√	√		
			CO3				√	
			CO4					√

LIST OF EXPERIMENTS

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices.
7. Write a program to sort numbers using the sorting Algorithm.
8. Represent a deck of playing cards using arrays.
9. Write a program to check that the input string is a palindrome or not.
10. Write a program to read a string and write it in reverse order.
11. Write a program to concatenate two strings.
12. Write a program which manipulates structures (write, read, and update records).
13. Write a program which creates a file and writes into it supplied input.

Write a program which manipulates structures into files (write, read, and update records).
Note: At least 5 to 10 more exercises to be given by the teacher concerned.

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, 2010, New Delhi.

REFERENCE BOOKS

- Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
- Computer Fundamentals and Programming in C, Reema Theraja, Oxford
- Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.

MECHANICAL WORKSHOP LAB	
Course Code: 23ME152/23ME252	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. Study and practice on machine tools and their operations.
2. Practice on manufacturing of components using workshop trades includingfitting,
3. To study basics of carpentry, foundry and welding.
4. Identify and apply suitable tools for machining processes including turning, facing.

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 different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.)processes required to manufacture a product from the raw materials.
2. Use different measuring, marking, cutting tools used in the workshop.
3. Be aware of the safety precautions while working in the workshop.

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

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES		
	CLO1	CLO2	CLO3
CO1	✓	✓	✓
CO2	✓	✓	✓
CO3	✓	✓	
CO4			✓

LIST OF EXPERIMENTS

Fitting Practice:

Use of hand tools in fitting, preparing a male and female joint of M.S. or making a paperweight of M.S.

Carpentry Practice:

Study of Carpentry Tools, Equipment and different joints.

Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

Smithy

Tools and Equipments –Simple exercises base on smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging, Making simple parts like hexagonal headed bolt, chisel

Welding Practice (Basic Theory to be explained prior topractice):

Gas Welding& Electric Arc welding Practice.

A joint such as a Lap joint, a T-joint or a Butt joint is to be prepared or to make furniture.

Machining (Basic Theory to be explained prior to practice):

(i) Stepped cylindrical Turning of a job and Thread-cutting in lathe. (ii) Shaping (iii) Milling

TEXT BOOKS

1. Laboratory Manual
2. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice –Theory, practice and workbook", Suma Publications, 2005

REFERENCE BOOKS

1. Kannaiah,P. & Narayanan,K.C. —Manual on Workshop Practice", Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. —First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999

ENGINEERING GRAPHICS & DESIGN LAB	
Course Code: 23ME153/23ME253	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. Draw orthographic projections of lines, planes and solids.
2. Construct isometric scale, isometric projections and views.
3. Draw sections of solids including cylinders, cones, prisms and pyramids.
4. 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 AutoCAD.
2. Imagine and convert isometric view into orthographic projections and vice versa.
3. Should be able to understand the simple machine components and draw its projections
4. Familiarize with projections of lines, planes, solids, isometric projections.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO4
I/II	23ME153/252	Engineering Graphics & Design Lab	CO1	√			
			CO2		√		
			CO3			√	
			CO4				√

COURSE CONTENTS

S.No	LIST OF EXPERIMENTS
1	**Introduction**: **Auto CAD** Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning Line Conventions layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP &LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Coordinate points, axes, poly lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror,rotate, trim, extend, break, chamfer, fillet, curves, constraints. 2 – Sheets
2	**Orthographic Projections:** Introduction, Definitions - Planes of projection, reference line and conventions employed,Projections of points in all the four quadrants, Projections of straight lines (located in Firstquadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.2 – Sheets
3	**Orthographic Projections of Plane Surfaces (First Angle Projection Only):** Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method, **only 1-Sheet**
4	Projections of Solids (First Angle Projection Only): Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. 2-Sheets
5	**Sections and Development of Lateral Surfaces of Solids** Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes andTrue shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. 2 – Sheet
6	Isometric Projection (Using Isometric Scale Only): Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. 2-Sheets

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. Gopalakrishna, 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 InternationalPublisher, New Delhi

a. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
b. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press 2nd Edition.
c. Business Communication Today by Courtland L Bovee and Thill, Pearson.

COMMUNICATIVE ENGLISH LAB	
Course Code: 24HS151/24HS251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

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. 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 & COURSE LEARNING OUTCOMES

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-1

- Listening and Speaking
- Practicing Sounds of English
- Accent in speech (British and American)

Unit-2

- Role-play
- Extempore
- Public Speaking and Rhetoric

Unit-3

- Presentations
- Interview Simulations
- Group Discussions and Debates

Unit-4

- Guided composition
- Free-writing
- Reading comprehension practice: Technical and General text

TEXT BOOKS

i. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.

ii. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.

iii. 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,
2. Oxford University Press.
3. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press. 2nd Edition.
4. Business Communication Today by Courtland L Bovee and Thill, Pearson

SEMESTER II

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24AS201	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
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 differential equations.
2. To familiarise the students for the Special function-Series Solutions, Bessel's & Legendre's Differential Equations and their properties.
3. To describe Laplace and inverse Laplace transforms with their properties.
4. To understand Analytic functions, Construction of Analytic Functions and Conformal Mapping.
5. To equip the students with concept of Complex Integration, Tayler'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. Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.
2. Obtain series solution of differential equation and explain applications of Bessel's and Legendre's Differential Equations.
3. Apply Laplace transforms to find the solution of initial value and boundary value problems.
4. Demonstrate the concept of Analytic functions & its constructions, Conformal Mapping
5. Evaluate Complex Integration, Taylor's and Laurent's Expansion, Singularities and Residues.

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

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	√				
CO-02		√			
CO-03			√		
CO-04				√	
CO-05					√

COURSE CONTENTS

Unit-1: Linear Differential Equations

Linear differential equation with constant Coefficient , Complimentary Functions, Particular Integrals, Euler – Cauchy differential equations, Second order linear differential equations –One part of CF is known, Reduction to Normal form, Variation of Parameters & Method of undetermined coefficient.

Unit-2: Series Solutions

Power series method, validity of series method, Frobenius Method. Bessel's Equation, Bessel's function, Generating Function, Recurrence Relations, Orthogonal properties of Bessel's functions, Transformation of Bessel's Equation., Legendre's Equation, Legendre Polynomials, Generating Function, Recurrence Relations, Rodrigue's formula, Orthogonal properties of Legendre's polynomials.

Unit-3: Laplace Transforms

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, Simple Applications of Laplace transforms for solving IVP.

Unit-4: Complex Variable - I

Introduction, Limit, continuity, Differentiability and Analyticity of functions, Cauchy-Riemann Equations (Cartesian and polar), Harmonic functions, Construction of Analytic Function, Determination of Harmonic conjugate, Milne-Thomson's method.

Unit-5: Complex Variable - II

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 and Simple Applications.

TEXT BOOKS/REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017
2. J.W. Brown and R.V. Churchill, Complex Variables and Applications, McGraw Hill, 9th edition, 2013.
3. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017
4. Kandasamy P et al. Engineering Mathematics, S. Chand & Co., New Delhi, revised edition.
5. Dass H. K., Advanced engineering Mathematics, Sultan Chand Publication, Delhi, 2013.

ELEMENTARY MATHEMATICS-II (For BME only)	
Course Code:24AS204	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Elementary Mathematics-I	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Differentiation of several variables.
2. To introduce the concept of Vector Calculus, Gradient, Divergence and Curl.
3. To introduce the concept of Second order differential equations and their applications.
4. To get the knowledge that illustrate the complex numbers.
5. To familiarize with the concept of complex variables.

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 differentiation of several variables.
2. Apply the knowledge of vector calculus in real life applications.
3. Apply the knowledge of Second order differential equations in solving simple problems.
4. Understand the complex number system and their uses.
5. Apply the knowledge to construct analytic functions.

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

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

COURSE CONTENTS

Unit-1: Complex Numbers
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.

Unit-2: Successive Differentiation
Successive differentiation, n^{th} order derivatives of standard functions, Leibnitz theorem (without proof).

Unit-3: Differential Calculus of Several Variables
Introduction, Limit & Continuity, Partial derivatives, Homogeneous functions and Euler's theorem, Total derivatives, Jacobians, Properties of Jacobians.

Unit-4: Vector Calculus
Introduction, Scalar and vector point functions, differentiation formulae, Level surface, Gradient, Divergence, Curl, Directional derivatives, Simple Applications.

Unit-5: Linear Differential Equations
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.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
2. Jain R. K., Iyengar S. R. K., "Advanced Engineering Mathematics", 6th Edition, Narosa Publishing House, 2019.
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.

GERMAN-II	
Course Code: 24FLGR201- II	**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 courseintends to develop an ability for discussions, debates, research ventures, etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositionsin legal contexts.

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.

COURSE LEARNING OUTCOMES (CLOs):

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

1. Read and write short, simple texts.
2. Have Fluency in reading and writing.
3. Understand the dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. Know the culture of the countries where the German language is spoken.

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

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT- 1

- Zeit-Ausdrücke, Tagesteile, Uhrzeit
- Präpositionen mit Akkusativ/Dativ, Ordinalzahlen
- Wegbeschreibung, Reisen, Verkehrsmittel
- Das Haus

UNIT- 2

- Modalverben
- Essen und Trinken, Mahlzeiten, Tagesablauf, Messeinheiten, Einkaufen
- Körperteile und Krankheiten
- Futur

UNIT- 3

- Dativ, Artikel und Personalpronomen im Dativ, Verben und Präpositionen mit Dativ, Konjugation und Verwendung von Verben (geben, kaufen, schenken, gratulieren, gehören, gefallen, gehen, fahren, fliegen, usw.)
- Possessiv-Artikel
- Trennbare Verben, Untrennbare Verben

UNIT 4

- Perfekt
- E- Mail Schreiben/ SMS Schreiben
- Vergangenheit erzählen, Das Wochenende, Lebenslauf

TEXT BOOKS :

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)
  Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach Grammatik." Übungsgrammatik Deutsch A1 bis B 1 (2012): 329-330.Einfach Gramatik, Paul Rusch
- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." Die Unterrichtspraxis/Teaching German 44.1 (2011): 46-49.
- Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. Tangram: Deutsch als Fremdsprache. Lehrerbuch. Vol. 1. Hueber Verlag, 1998.
- Wolfgang Hieber: Lernziel Deutsch, Teil 1,Max HueberVerlag, 1984.

WEBSITE PAGES:

- https://www.nthuleen.com/teach.html

FRENCH-II	
Course Code: 24FLFR201-II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: French-I	

COURSE OBJECTIVE (COs)

1. To develop **listening, speaking, reading and writing** requisites of a language.
2. To develop the ability **to construct sentences** and **frame questions**.
3. To equip the students with **cultural elements and communication strategies** which will help them **communicate in varied situations.**
4. To familiarise the students with the **French and Francophone culture.**

COURSE LEARNING OUTCOMES (CLOs)

1. After completion of this course, the student will be able **to express and interact in French** used in daily conversations.
2. The student will be able **to write short and simple texts.**
3. The student will be able to **initiate, understand and respond to the queries of cultural significance in various settings.**
4. The student can demonstrate **knowledge and understanding** of French and Francophone culture.

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

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	**Journée Typique**	Parler de N os Habitudes, Exprimer l'Heure, S'Informer sur l'Heure, le Moment et la Fréquence.	Les Verbes Pronominaux au Présent. Les Verbes Aller et Sortir	L'Heure, Les Moments de la Journée. Les Activités Quotidiennes. Les Adverbs. La Météo.
2	**Achats**	S'informer sur un Produit. Acheter et Vendre un Produit. Donner Son Avis. Parler du Temps qu'il Fait	Les Adjectifs Interrogatifs. Les Adjectifs Démonstratifs. Le Genre et le Nombre. Le Verbe Prendre.	Les Vêtements. Les Couleurs. Les Fruits et Les Légumes.
3	**Alimentation**	Parler des Plats et des Aliments. Commander un Menu dans un Restaurant. Situer une Action dans le Futur	Le Future Proche: Aller +Infinitif. Les Partitifs. Les Pronoms COD. Le Future.	Les Aliments. Le Lexique des Quantités.
4	**expérience vécue**	Parler de faits passés. Parler de Nos expériences. Parler de ce que nous savons faire.	Le Passé Composé. L'Imparfait.	Les Verbes Savoir, Pouvoir et Connaître. Les Adjectifs Qualificatifs. Le Lexique des Savoirs et Compétences. Le Récit de Vie.

TEXT BOOK

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

REFERENCE BOOKS

- Alter Ego 1, Livre d'élève, Berthet A. & Hugo C. & Kizirian M. V. & Sampsonis B. & Waendendries M., éd Hachette, Paris, 2006.
- Connexions 1, Loiseau Y. & Mérieux R., éd. Didier, Paris, 2004.
- Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, CLE International, Paris, 2013.
- Le Robert & Nathan Conjugation, Paperback, Le Robert Nathan, 2011.

SEMESTER – III

ENGINEERING MATHEMATICS – III	
Course Code: 23AS301	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE EDUCTIONALOBJECTIVES (CEO)

1. To familiarize the students with partial differential equations and their solution, Boundary value problem, Fourier transforms, z- transforms and basic concepts of Linear algebra.
2. To solve boundary value problems, Heat and Wave equations.
3. To gain good knowledge in the application of Fourier transform.
4. To demonstrate understanding Z-transform and analyzing Discrete signals by using Z-transform.
5. To understand Vector spaces, and Linear Transformation with it's properties.

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:

- Solve different types of partial differential equations.
- Find solutions of boundary value problems including heat and wave equations.
- Apply and analyze Fourier transforms with different applications.
- Evaluate the problems using z-transforms.
- Understand linear algebra and its application to Engineering.

MAPPING COURSE EDUCTIONALOBJECTIVES & COURSE LEARNING OUTCOMES

CLO / CEO	01	02	03	04
01	✓			
02	✓			
03		✓		
04			✓	
05				✓

COURSE CONTENTS

Unit-I: Partial differential equation – I

Formation of partial differential equation by eliminating arbitrary constants and arbitrary functions. Formation of partial differential equation by eliminating arbitrary functions of the form $\varphi(u, v) = 0$. Solution of standard types of first order equations. Solution of standard types of first order equations. Lagrange's linear equation of first order. Linear Homogeneous partial differential equations of second and higher order with constant coefficients. Formation - Solution of standard types of first order equations - Lagrange's equation - Linear homogeneous partial differential and second and higher order with constant coefficients.

Unit-II: Partial differential equation – II

Classification of partial differential equations. Method of separation of variables. One dimensional Wave Equation and its possible solutions. Initial and Boundary value Problems with zero velocity – related problems and Non-zero velocity- related problems. One dimensional heat equation and its possible solutions. Steady state conditions and zero boundary conditions related problems. Introduction to two dimensional heat equation and its possible solutions in steady state. Two dimensional heat equation - Steady state heat flow equation

Unit- III: Fourier Transforms

Fourier Transforms- Elementary properties of Fourier transforms. Fourier Transforms and related problems- Fast Fourier Transform. Fourier Sine Transforms and their properties-problems. Fourier Cosine Transforms and their properties-problems. Convolution Theorem (without proof)-applications. Parseval's Identity (without proof)-applications.

Unit-IV: Z – Transforms

Z Transforms: Definition and properties of Z- Transforms, Inverse Z- Transforms, and Application of Z-Transforms to difference equations.

Unit-V: Vector Spaces

Vectors in two dimensional space and n-dimensional space, Vectors addition and scalar multiplication of Vectors, Vector Spaces: Definition and Examples General properties of vector spaces, Linear combination of Vectors, Linear independence and Linear dependence of Vectors. Linear transformations, linear operators, Properties of Linear Transformation, Algebra of Linear transformation, Matrix Representation of linear transformation, Linear map Associated with Linear Transformation.

TEXT BOOKS

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017.
2. Grewal B.S., Higher Engineering Mathematics, 44th edition, Khanna Publishers, 2019
3. Gilbert Strang, Introduction to Linear Algebra, Fifth Edition (2016)

REFERENCE BOOKS

1. R.V. Churchill and J. Brown.: "Fourier Series and Boundary Value Problems" McGraw-Hill Book Company 8th edition-2017.
2. M.D. Raisinghania: "Advanced Differential Equations"S. Chand Publishing2018
3. LoknathDebnath, Integral Transforms and their applications, Chapman and Hall/CRC; 2 edition, 2014

DATA STRUCTURE	
Course Code: 24CS2001	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 0 0	
Credits: 3	

COURSE OBJECTIVES

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

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. Implement linear and non–linear data structure operations.
3. Use appropriate linear/non–linear data structure operations for solving a given problem.
4. Apply appropriate graph algorithms for graph applications.
5. Analyze the various searching and sorting algorithms.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**LISTS** Introduction to Data Structure -Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.
UNIT-II	**STACKS AND QUEUES** Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.
UNIT-III	**TREES** Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.
UNIT-IV	**MULTIWAY SEARCH TREES AND GRAPHS** B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal –– Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm.
UNIT-V	**SEARCHING, SORTING AND HASHING TECHNIQUES** Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing.

TEXT BOOKS

- Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
- Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007.

REFERENCE BOOKS

- Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
- Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
- Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

DATABASE MANAGEMENT SYSTEMS	
Course Code: 23CS2005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T 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 the 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 Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.
5. Understand and apply the concept of transaction, concurrency control and recovery in database.
6. Understand the 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
CO1	✓	✓				
CO2			✓			
CO3				✓		
CO4					✓	
CO5						✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION:** Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages - DDL, DML, Database Architecture, Database Users and Administrators, History of Data base Systems, Database design , ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises, Relational Model - Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views Destroying/ altering Tables and Views
UNIT-II	**RELATIONAL ALGEBRA AND CALCULUS:** Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus - Tuple relational Calculus - Domain relational calculus - Expressive Power of Algebra and calculus. Form of Basic SQL Query - Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.
UNIT-III	**NORMALIZATION:** Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design - Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.
UNIT-IV	**TRANSACTIONS & RECOVERY:** 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	**CURRENT TRENDS:** Object DBMS- Distributed Database- Parallel Database- Mobile database- Geographic Information system-Multimedia Database- Temporal Database- Data Warehousing and Data Mining.

TEXT BOOKS

- S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
- Thomas Connolly, Carolyn Begg. Database Systems, 3rd Edition – Pearson Education.
- Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
- Date C. J., An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

REFERENCE BOOKS

- Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
- M.Tamer Ozsu , Patrick Ualduriel, "Principles of Distributed Database Systems", Second Edition, Pearson Education, 2003.
- Vipin.C.Desai , An introduction to Database System , West Pub. Co

PROGRAMMING IN PYTHON	
Course Code: 24CS2007	Continuous Evaluation: 40 Marks
Pre-Requisite : Basic Programming Fundamentals	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE
1. To understand basics of Python and its data types. 2. To analyse the input/output operations, functions, and operators. 3. To develop object-oriented programming skills, including classes, modules, and exception handling. 4. To create files, use packages, and apply regular expressions. 5. To analyze and visualize data using NumPy, Pandas, and Matplotlib

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 basics of Python, syntax, data types, and control structures for programming skills.
2. Implement input/output operations, functions, and operators to solve real-world problems.
3. Develop object-oriented programs using classes, modules, and exception handling to solve computation problem.
4. Construct files, utilize packages, and apply regular expressions for robust data handling.
5. Interpreting data using Python libraries like NumPy, Pandas, and Matplotlib for visualization.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**OVERVIEW OF PYTHON** **Introduction of Python:** History and Need for Python, Python Installation and IDLE, Python Syntax, Identifiers, and Keywords. **Data Types and Objects**: Basic Data Types: Integral and Floating Point, Numerical Types and Expressions, Variables and Constants, Comments and Documentation Strings, Type Conversion. **Branching and Iteration**: Conditional Statements (if, elif, else), Looping Constructs (for, while), Control Flow Statements (break, continue, pass), Iteration Techniques. **Structured Data Types**: 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, Relationship between tuple and dictionary, Relationship between tuple and list.
UNIT-II	**Basic Input/Output**: Reading from and Writing to the Console, Working with Strings and String Methods, String Slicing. **Functions**: 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(), Function Decorators and Generators. **Operators and Expressions**: Expressions, Assignment, Arithmetic, Comparison, Logical, Bitwise Operators, Membership and Identity Operators, Complex Expressions and Precedence Rules, Boolean Expression.
UNIT-III	**Modules**: Creating and Using Modules, The Special Variable '__name__', Structured Programming Principles. **Classes in Python:** New Style Classes, Creating Classes, Instance Methods, Inheritance, Polymorphism, Method overriding, Method Overloading, Data hiding. **Exception Handling**: Types of Errors (Compile- Time, Runtime, Logical), Exception Handling Using try-except Blocks, The assert Statement, User-Defined Exceptions, Logging Exceptions, Exception Classes & Custom Exceptions.
UNIT-IV	**File Handling:** 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. **Regular Expressions:** RE Operations, Using Special Characters, RE Methods, Named Groups, RE with globe Module. **Iterators and Generators:** Iterator Protocol, Generators and Yield Statement. **Packages**: Importing Modules, Creating and Using Packages, Standard Libraries Overview.

UNIT-V	**Introduction to Data Science:** Overview of Data Science Workflow, Python Libraries for Data Science (NumPy, Pandas, OS, SyS, SciPy, Visby, Statsmodels, Scikit-learn), Working with Arrays Using Libraries like NumPy. **Data Analysis and Visualization:** Analyzing Numerical Data with NumPy, Data Manipulation with Pandas, Data Visualization Techniques, Plotting with Matplotlib and Seaborn.

TEXT/REFERENCE BOOKS

- S, G., & A, V. (2018). Introduction to Python Programming (1st ed.). Chapman and Hall/CRC.
- Boschetti, A., & Massaron, L. (2018). Python Data Science Essentials: A practitioner's guide covering essential data science principles, tools, and techniques, 3rd Edition. Packt Publishing.

REFERENCE BOOKS

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

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 21CS2111	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To explain 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 system.

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

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

LIST OF EXPERIMENTS

1. Introduction to SQL.
2. To study Basic SQL commands (create database, create table, use , drop, insert) and execute the queries using these commands.
3. To study the viewing commands (select , update) and execute the queries using these commands.
4. To study the commands to modify the structure of table (alter, delete, drop, add, modify) and execute the queries using these commands.
5. To study the commands that involve compound conditions (and, or, in , not in, between , not between , like , not like) and execute the queries using these commands.
6. To study the aggregate functions (sum, count, max, min, average) and execute the queries using these commands.
7. To study the grouping commands (group by, order by) and execute the queries using these commands.
8. To study the commands involving data constraints and execute the queries using these commands.
9. To study the commands for aliasing and renaming and execute the queries using these Commands.
10. To study the commands for joins (cross join, inner join, outer join) and execute the queries using these commands:
11. Study of Integrity Constraints in SQL.
12. Study of Use of Group By and Having Clause.

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

TEXT BOOKS

- Laboratory Manual
- S.K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education India, 2009
- Thomas Connolly, Carolyn Begg. Database Systems, 3rd Edition – Pearson Education.
- Korth, Silberschatz, Database System Concepts, 4th Ed., TMH, 2000.
- Date C. J., An Introduction to Database Systems , 7th Ed., Narosa Publishing, 2004.

REFERNCE BOOKS

- Elmasri Navathe, Fundamentals of Database Systems, 5th Edition Pearson Education.
- M.Tamer Ozsu , Patrick Ualduriel, “Principles of Distributed Database Systems”, Second Edition, Pearson Education, 2003.
- Vipin.C.Desai , An introduction to Database System , West Pub. Co

PYTHON PROGRAMMING LAB	
Course Code: 24CS2015	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To outline the basics of python programming, Features, history, datatypes, variables, conditional statements, and looping.
2. To acquire Object Oriented Skills, Functions, and Modules in Python.
3. To constructs of Python language such as Exception Handling, Operators, Expressions, and Arrays.
4. To Gain experience with File handling and data manipulation.
5. To enhance problem solving skills through practical python applications

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 comprehend the basics of python programming, and built-in data structures list, sets, tuples, and dictionary.
2. Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
3. Understand and use the concept of Exception Handling, Operators, Expressions, and Arrays.
4. Focuses on working with different file formats (text, CSV, JSON) and using libraries like NumPy for data analysis.
5. Apply programming knowledge to solve real-world problems involving data analysis and visualization.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**
CO1	√			
CO2		√		
CO3			√	
CO4				√

LIST OF PROGRAMS

1. Implement basic Python programs using variables, data types, operators, and control flow statements (if, else, for, while).
2. Define and utilize functions with different argument passing mechanisms (positional, keyword, default).
3. Create custom classes in Python and demonstrate inheritance and polymorphism concepts.
4. Write a program that reads data from a CSV file containing student information (name, roll number, marks) and calculates the average mark for each student.
5. Import and utilize modules and packages for enhanced functionality in Python programs.
6. Employ exception handling techniques (try-except blocks) to manage errors in programs.
7. Work with NumPy arrays for efficient numerical computations.
8. Design and implement iterators and generators in Python.
9. Utilize Pandas library for data manipulation, cleaning, and analysis.
10. Create data visualizations using Matplotlib and Seaborn libraries.
11. Develop a program to simulate a simple ATM machine with functionalities like balance inquiry, cash withdrawal, and deposit. (Use exception handling)
12. Create a program to copy a text file to a new location with a different name. (Implement error handling for file not found)
13. Create a program that utilizes Seaborn to visualize the correlation between different features in a dataset (optional - requires understanding of data analysis concepts).
14. Develop a program that uses Matplotlib to create a bar chart showing the distribution of ages in a given dataset.
15. Develop a program to remove duplicates from a given list.

TEXT BOOKS

- S, G., & A, V. (2018). Introduction to Python Programming (1st ed.). Chapman and Hall/CRC.
- Boschetti, A., & Massaron, L. (2018). Python Data Science Essentials: A practitioner's guide covering essential data science principles, tools, and techniques, 3rd Edition. Packt Publishing.

REFERENCE BOOKS

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

DATA STRUCTURES LAB	
Course Code: 24CS2113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

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
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

LIST OF PROGRAMS

1. Implementation of Singly Linked List
2. Implementation of Polynomial Manipulation using Linked list
3. Linked list implementation of Stack and Linear Queue ADTs
4. Array implementation of Stack, Queue and Circular Queue ADTs
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra's Algorithm
10. Implementation of Prim's Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort.

TEXT BOOK:

- Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson, Education, 2005.
- Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

REFERENCE BOOKS

- Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
- Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
- Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

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: 23CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To understand and design various finite Computing models.
2. To gain knowledge about the concepts of grammar, normal forms and regular expressions and PDA.
3. To understand the Recursive and Recursively enumerable languages , Decidability and Undecidability of various 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. Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.
2. Student understands the basics of regular expression and its equivalence.
3. Disambiguate context-free grammars by mastering the concepts of context- free languages and push- down automata
4. Study the concepts of Push Down Automata and its applications.
5. Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√	√			
CO2			√	√	
CO3					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**BASIC COMPUTATIONAL CONSTRUCTS** Finite State Systems, Basic Definitions Non-Deterministic finite automata(NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA Finite automata with Ɛ-moves, minimization of finite Automata, Concept of basic Machine, Properties and limitations of FSM, Moore and Mealy Machines, Equivalence of Moore and Mealy machines, pumping lemma.
UNIT-II	**REGULAR EXPRESSIONS** Regular grammars, regular expressions, equivalence between regular languages, properties of regular languages, Regular Expressions, Equivalence of finite automata and Regular Expressions, Regular expression conversion and vice versa. Conversion of NFA to DFA by Arden's Method.
UNIT-III	**GRAMMAR** Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, Chomsky Hierarchy, LR(k) Grammars, properties of LR(k) grammars, Simplification of CFG, Normal forms
UNIT-IV	**PUSHDOWN AUTOMATA** Pushdown Automata –Definition, Instantaneous Description, Applications of Pushdown Machines, NDPDA and DPDA, Equivalence: PDA to CFL and vice-versa, pumping lemma for CFL..
UNIT-V	**TURING MACHINES & COMPUTATIONAL COMPLEXITY** Turing Machines- Introduction, Definition, Instantaneous Description, Turing machine as Acceptors, Halting problem of T.M., Undecidability: Basics, Post's Correspondence Problem, Rice's Theorem, Properties of Recursive and Recursively Enumerable Languages, Introduction to NP-Hardness and NP-Completeness.

TEXT BOOKS

- E. Hopcroft and J. D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson, Education Publishers, 2nd Edition, 2004

REFERENCE BOOKS

- Michael Sipser, "Introduction to the Theory of Computation", Thomson Asia, 2004
- J.C.Martin, "Introduction to Languages and Theory of Computation", McGraw Hill,2003
- K.L.P. Mishra, N.Chandrasekaran , " Theoretical Computer Science ", PHI, 3rd Edition, 2007

OPERATING SYSTEMS	
Course Code: 24CS2006	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To understand the main components of an OS & their functions.
2. To study the process management and scheduling.
3. To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
4. To understand the concepts and implementation Memory management policies and virtual memory.
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

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 basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.
2. Understand the process management policies and scheduling of processes by CPU .
3. Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.
4. Describe and analyze the memory management and its allocation policies.
5. Identify use and evaluate the storage management policies with respect to different storage management technologies.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√				
CO2		√	√		
CO3		√	√		
CO4				√	√
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** **Operating System Overview**-Definition and functions, Types of Operating Systems, Various Operating system services. **Operating System Structure-** Layered structure approach, kernel Approach and Virtual machine approach.
UNIT-II	**PROCESSES & SCHEDULING** **Process concept**- Process State Diagram- PCB, Concept of Threading and Multithreading, Operation on processes, Scheduling criteria, CPU scheduling algorithms- FCFS, SJF, SRTF, RR, PRIORITY, HRRN. Process Synchronization- Critical Section Problem, Classical Synchronization Problem.
UNIT-III	**CONCURRENCY** Principles of concurrency - mutual exclusion, semaphores, monitors, Readers/Writers problem, Producers/Consumers problem. Deadlocks – Prevention, Avoidance, Detection.
UNIT-IV	**MEMORY MANAGEMENT STRATEGIES** Address Binding, Logical-Physical Address Space, swapping, contiguous memory allocation, non- contiguous memory allocation technique, Virtual Memory Management - Demand Paging & Page-Replacement Algorithms, Demand Segmentation.
UNIT-V	**FILE SYSTEMS** 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.

TEXT BOOKS
• William Stallings, "Operating Systems – internals and design principles", Prentice Hall India, 5th Edition, 2005.
• Design of the Unix Operating System By Maurice Bach, PHI.
• Silberschatz, Peter Galvin, "Operating System Concepts", AWL 6 th Edition, 2002.
REFERENCE BOOKS
• Andrew S. Tannenbaum & Albert S. Woodhull, "Operating System Design and Implementation", Prentice Hall India, 2 nd Edition, 1998.
• Ida M. Flynn, Ann Mclver McHoes, "Understanding Operating Systems", 3rd Edition,Thomson Learning 2001s.
• Gary Nutt, "Operating System - A Modern Perspective", Pearson Education Asia, 2nd Edition 2000. Harvey .M. Deitel, "Operating Systems", 2nd Edition , 2000.

JAVA PROGRAMMING	
Course Code: 24**CS2010**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES
1. To understand Object Oriented Programming concepts and basics of Java programming language 2. To know the principles of packages, inheritance and interfaces 3. To develop a java application with threads and generics classes 4. To define exceptions and use I/O streams 5. To design and build Graphical User Interface Application using JAVAFX

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. Apply the concepts of classes and objects to solve simple problems 2. Develop programs using inheritance, packages and interfaces 3. Make use of exception handling mechanisms and multithreaded model to solve real world problems 4. Build Java applications with I/O packages, string classes, Collections and generics concepts 5. Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO OOP AND JAVA** Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments
UNIT-II	**INHERITANCE, PACKAGES AND INTERFACES** Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.
UNIT-III	**EXCEPTION HANDLING AND MULTITHREADING** Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.
UNIT-IV	**I/O, GENERICS, STRING HANDLING** I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.
UNIT-V	**JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS** JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

TEXT BOOKS

- Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
- Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCE BOOKS

- Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.
- Introduction to Java programming, Y. Daniel Liang, Pearson Education.
- Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
- Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
- Java Programming and Object Oriented Application Development, R. A. Johnson, Cengage Learning

DISCRETE STRUCTURES	
Course Code: 24CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. Understand and construct simple mathematical proofs using logical arguments.
2. To illustrate by examples the basic terminology of sets, relation and function.
3. To identify the number of possible outcomes of an experiment/ algorithm in multiple stages.
4. To illustrate by example basic terminology of graph theory and model problems in computer science using graphs.
5. To understand the basic constructs of algebraic systems and number theory.

COURSE LEARNING OUTCOMES (CLO)
The syllabus and 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						

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INRODUCTION TO LOGIC** 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	**BASIC MATHEMATICAL STRUCTURES** **Sets,** definition, types of sets, Venn Diagram, using set notation with Quantifier, Set Operations, Set Identities. **Functions,** definition and properties, types of functions, comparing infinite sets using functions, countable and countably infinite sets. **Relation:** equivalence relations and partitions of a set, partial order relations, posets, Hasse diagram, chains, anti-chains.
UNIT-III	**COUNTING TECHNIQUES** **Basic Counting Techniques:** product and sum principles, the bijection principle, division rule, double counting, Handshake lemma, the binomial theorem, Pascal's triangle, permutations and combinations with and without repetitions. **Advanced counting Techniques:** Sequences: Sum of sequences and product of sequences, estimating factorials, recurrence relations, Solving recurrence relations, Solving recurrence relations via generating functions. Counting techniques: Pigeon-hole principle (PHP), its variants and its applications,
UNIT-IV	**GRAPH THEORY** Basic terminology, Konigsberg bridge problem, Eulerian graphs, Hamiltonian Graphs, Bipartite graphs and a characterization, Planar Graphs , Representation of graphs, Graph isomorphism and Homomorphism, Graph Coloring Subgraphs, cliques and independent sets, large bipartite subgraphs, connected components, cut edges, Matchings, Perfect and maximum matchings.
UNIT-V	**ALGEBRAIC SYSTEMS & NUMBER THEORY** **Algebraic systems:** Semigroup, Monoid, Groups, Abelian group, Cyclic Group, Subgroup, order of a group and subgroups, Lagrange's theorem, group isomorphism and homomorphism. **Number Theory:** Modular arithmetic and applications to cryptography; Euclid's Algorithm, primes, Chinese Remainder theorem.

TEXT BOOKS
• Kenneth H.Rosen, Discrete Mathematics and its Application, Fifth edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2003
• C.L.Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000
• Discrete Mathematics, N L Biggs.
• *Introduction to Graph Theory, 2nd Edition*, by Douglas B West. Eastern Economy Edition published by PHI Learning Pvt Ltd.

REFERENCE BOOKS
• Bondy J. A., Murty U. S. R., *Graph Theroy*, Springer, 2013.
• Tremblay J. P. and Manohar R., "Discrete Mathematical Structures with applications • to Computer Science", Tata Mc Graw Hill Publishing Co., 2000
• Concrete Mathematics: A Foundation for Computer Science, R Graham, D Knuth and O Patashnik.
• Introduction to Theory of Numbers, I Niven and H Zuckerman.
• An Introduction to the Theory of Numbers, G H Hardy and E M Wright.
• Combinatorics: Topics, Techniques, Algorithms, Peter Cameron.
• A Course in Combinatorics, J H van Lint and R M Wilson.
• Ralph P Grimaldi, Discrete and Combinatorial Mathematics, 5th Edition, Pearson, 2004.

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	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 the 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 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					√

LIST OF PROGRAMS

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a LRU
6. Write a program for page replacement policy using FIFO.
7. Write a program for page replacement policy using Optimal.
8. Write a program to implement first fit, best fit and worst fit algorithm for Memory management.
9. Write a program to implement reader/writer problem using semaphore.
10. Write a program to implement Banker's algorithm for deadlock avoidance.

TEXT BOOKS

- Abraham Silberschatz Peter B. Galvin and Greg Gagne, Operating System Concepts, Wiley 8th Edition, 2008.
- Garry. J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley
- Andrew S. Tanenbaum and Herbert Bros, Modern Operating Systems (4th Edition), Pearson

REFERENCE BOOKS

- William Stallings, "Operating Systems – internals and design principles", Prentice Hall India, 5 th Edition, 2005.

JAVA PROGRAMMING LAB	
Course Code: 23CS2116	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
CO1	√			
CO2		√		
CO3			√	√

LIST OF PROGRAMS

1. WAP in Java illustrating various data types in Java
2. WAP in Java illustrating class, objects and methods.
3. WAP in Java for addition and multiplication of Matrices.
4. WAP in Java illustrating the concept of Overloading.
5. WAP in Java illustrating the implementation of Various forms of Inheritance.
6. WAP in Java illustrating Overriding methods.
7. WAP in Java illustrating Exception Handling
8. WAP in Java to manipulate strings
9. WAP in Java illustrating Interfaces in Java
10. WAP in Java to create Packages.
11. WAP in Java illustrating Threads.
12. WAP in Java to manipulate labels, lists, text fields and panels using AWT.
13. WAP in Java to handle mouse events.
14. WAP in Java using layout mangers.
15. WAP in Java for Collections.
16. WAP in Java for both user defined and built-in annotation.
17. WAP in Java for illustrating the use of Autoboxing.

Learning Resources	
Reference Book and other materials	**1.** Laboratory Manual

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II	
Course Code: 23CS0202	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
L T 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 method 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 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**
TO1	√			
TO2		√		
TO3		√	√	
CO4			√	√

TRAINING CONTENTS

MODULE	TRAINING CONTENTS	STUDENTS ENGAGEMENT ACTIVITY
I	**INTRODUCTION:** 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
II	**PROBLEM SOLVING:** Depth-first, breadth-first search, Problem Reduction, Constraint Satisfaction , Means-End Analysis.	Solving manually constraint satisfaction problem
III	**INTRODUCTION TO MACHINE LEARNING** Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques.	Identification of ML Model based on Application
IV	**CLASSIFICATION PROBLEM** Machine learning Algorithms for classification problem	Design decision trees
V	**HANDS ON ACTIVITY :** 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.

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.

LIVE PROJECT-I & INDUSTRIAL VISIT	
Course Code: 21CS0204	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 site 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 a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

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

	CLO1	CLO2
CO1	√	√

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: 24CS3001	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 know the various phases of the compiler
2. To understand the various parsing algorithms and comparison of the same
3. To provide practical programming skills necessary for designing a compiler
4. To gain knowledge about the various code generation principles
5. To understand the necessity for code optimization.

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. Apply the knowledge of LEX & YACC tool to develop a scanner and parser
2. Design and develop software system for backend of the compiler
3. Suggest the necessity for appropriate code optimization techniques
4. Conclude the appropriate code generator algorithm for a given source language
5. Design a compiler for any programming language.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	Compilers - Analysis of the source program - 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..
UNIT-II	Role of the parser - Writing Grammars - Context-Free Grammars - Top Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing - Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser
UNIT-III	Intermediate languages - Declarations - Assignment Statements - Boolean Expressions - Case Statements - Back patching - Procedure calls.
UNIT-IV	Introduction - Principal Sources of Optimization - Optimization of basic Blocks - DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis - Runtime Environments - Source Language issues - Storage Organization - Storage Allocation strategies - Access to non-local names - Parameter Passing - Error detection and recovery
UNIT-V	Issues in the design of code generator - The target machine - Runtime Storage management - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG based code generation - Peephole Optimization

TEXT BOOKS

- Alfred V. Aho, Jeffrey D Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Education Asia, 2012.
- Jean Paul Tremblay, Paul G Serenson, “The Theory and Practice of Compiler Writing”, BS Publications, 2005.
- Dhamdhere, D. M., “Compiler Construction Principles and Practice”, Second Edition, Macmillan India Ltd., New Delhi, 2008.
- D.M.Dhamdhere, "*System Programming and Operating Systems*", 2nd Edition., Tata Mcgrav Hill,1995

REFERENCE BOOKS

- Kenneth C. Louden, Compiler Construction, Principles and Practice, Thomson Books, 2007.
- Aho. A.V & Ullman J.D, “Principles of Compiler Design”, Narosa publications, 1985.
- S.S. Muchnick Harcourt Asra,” Advanced Compiler Design implementation”, Morgan Kauf12man, 1997.
- Anrew W. Appel, “Modern Compiler Implementation in JAVA”, Cambridge University Press, 2003.

LIVE PROJECT-II & INDUSTRIAL VISIT	
Course Code: 23CS0303	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 site 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 a first-hand experience on sites.
4. Apply the concepts learnt to design and create a application.

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

CLOs / COs	CLO1	CLO2
CO1	√	√

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.

COMPILER DESIGN LAB	
Course Code: 24CS3117	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 0 0 2	
Continuous Evaluation: 60 Marks	
End Semester Examination: 40 Marks	

COURSE OBJECTIVES

1. To be practically exposed to the compiler writing tools.
2. To be able to design and analyze the compiler.
3. To design a symbol table.
4. To implement various Parsing techniques.
5. To understand the basic steps for designing a compiler.

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. Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.
2. Learn application of different compiler writing tools to implement the different Phases of compiler.
3. Work in the development phase of new computer languages in industry and designing symbol tables.
4. Design Top-down, Bottom-up parsing Techniques.
5. Learn the process of translating a modern high-level language to executable code

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

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

LIST OF PROGRAMS

1. Implementation of Symbol Table.
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool.
4. Design a lexical analyzer for a given language and the lexical analyzer should ignore redundant spaces, tabs and newlines.
5. Simulate First and Follow of a Grammar.
6. Develop an operator precedence parser for a given language.
7. Construct a recursive descent parser for an expression.
8. Construct a LL(1) parser for an expression.
9. Design predictive parser for the given language.
10. Implementation of shift reduce parsing algorithm.
11. Design a LALR bottom up parser for the given language.
12. Implement the lexical analyzer using JLex, flex or lex or other lexical analyzer generating tools
13. Write a program to perform loop unrolling.
14. Implementation of LEXR using LLVM.
15. Implementation of handwritten parser using LLVM
16. Generating code with the LLVM backend.
17. Recursive descent parser for the CFG language and implement it using LLVM.
18. LR parser for the CFG language and implement it in the using LLVM

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

TEXT BOOKS
• Compilers Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman., Pearson.

REFERENCE BOOKS
• Engineering a Compiler, Second Edition, Keith D. Cooper & Linda Torczon., Morgan Kaufmann, Elsevier.
• Compiler Design, Sandeep Saxena, Rajkumar Singh Rathore., S.Chand publications

PROGRAMMING USING MATLAB	
Course Code: 24CS2115	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 basic concepts of MATLAB Software and its Tool Packages.
2. To give a comprehensive understanding of the numerical concepts and matrix problems are given.

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. Understand the importance of matlab commands and basic operations.
2. Implement various types of relational operator, constructor and arithmetic calculation.
3. Analyze and differentiate the various conditional loop & branch operation to observe performance.
4. Solve the various mathematical functions and equations using MATLAB also, observe the result of through plot graph.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**
CO1	√	√		
CO2		√	√	√

LIST OF PROGRAMS

1. Fundamental MATLAB Commands.
2. To study on basic Matrix Constructors and Operations.
3. To study on basic Arithmetic operations.
4. To study on 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 MATLAB program.
10. Differentiation and Integration with symbolic variables using MATLAB program.
11. Solving some Equations using MATLAB program.
12. Symbolic Functions using 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

Learning Resources	
Reference Book and other materials	**1.** Laboratory Manual **2.** "MATLAB: A Practical Introduction to Programming and Problem Solving" by Stormy Attaway (4th Edition, 2016,

	Butterworth-Heinemann)

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

TEXT BOOKS
• William Stallings, "Operating Systems – internals and design principles", Prentice Hall India, 5th Edition, 2005.
• Design of the Unix Operating System By Maurice Bach, PHI.
• Silberschatz, Peter Galvin, "Operating System Concepts", AWL 6 th Edition, 2002.
REFERENCE BOOKS
• Andrew S. Tannenbaum & Albert S. Woodhull, "Operating System Design and Implementation", Prentice Hall India, 2 nd Edition, 1998.
• Ida M. Flynn, Ann Mclver McHoes, "Understanding Operating Systems", 3rd Edition,Thomson Learning 2001s.
• Gary Nutt, "Operating System - A Modern Perspective", Pearson Education Asia, 2nd Edition 2000. Harvey .M. Deitel, "Operating Systems", 2nd Edition , 2000.

SEMESTER – VI

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM	
Course Code: 24CS3002	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE
1. Understand the fundamental concepts of AI and its applications. Relate theoretical concepts to real-world applications through case studies. ethical considerations and the societal impact of AI technologies.
1. Analyze different search algorithms and game playing techniques.
2. Understand techniques for handling uncertainty in AI systems and principles of knowledge-based systems with methods for knowledge representation, acquisition, organization, and manipulation..
3. Explore different types of AI planning and learning system.
4. Develop proficiency in AI techniques such as machine learning, neural networks, natural language processing, speech recognition and expert system.

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:
Understands the definitions and historical evolution of Artificial Intelligence, recognizing key milestones and advancements that have shaped the field.
Develop proficiency in state-space representation and search algorithms and gain an understanding of game theory basics.
Learn techniques for handling uncertainty in AI systems and apply knowledge representation methods
Gain fundamental concepts and components of AI planning and Learning systems.
Learn about various NLP, Pattern recognition and Expert Systems to understand how these models are used in real-world scenario.

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

CO \ CLO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**Introduction to AI and Intelligent Agents:** Definition and History of AI, State of Art -Different Types of Artificial Intelligence , AI application areas (Healthcare, Finance, Robotics, Natural Language Processing, Autonomous Systems), AI Techniques Ethical Considerations: Bias in AI, Fairness, Transparency, Accountability, AI regulations and policies. **Agents**: Definition of agents, Agent Environment, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems: Collaborating agents, Competitive agents. **Case Study:** 1. Google's DeepMind and AlphaGo: Discuss the architecture of AlphaGo, its environment, and how it represents a breakthrough in AI applications. OpenAI's GPT: Analyze the architecture and applications of GPT models, discussing the ethical implications of advanced AI systems.
UNIT-II	**Problem Solving and Search Algorithms** Characteristics of intelligent algorithm, State-Space Representation, Search space control: Uninformed Search Algorithms (BFS, DFS, Iterative Deepening), Informed Search Algorithms (Hill climbing, A*, Heuristics), Means-End Analysis, Stochastic search. Constraint satisfaction problem. **Game Playing and Adversarial Search** Game Theory Basics , Min-max Algorithm, Alpha-Beta Pruning **Case Study:** IBM's Deep Blue: Analyze Deep Blue's search algorithms focus on the use of heuristic search and game playing techniques.
UNIT-III	**Handling Uncertainty:** Monotonic Reasoning, Non-Monotonic Reasoning, Probabilistic reasoning, Use of certainty factors, Basics of Fuzzy logic. **Knowledge-Based Systems:** Mapping between facts and representations, Propositional Logic, First-Order Predicate Logic (FOPL), Clausal Form, Resolution, Unification algorithm. Approaches to knowledge representation, **Case Study:** MYCIN Expert System: Examine the MYCIN system for medical diagnosis, its use of probabilistic reasoning and fuzzy logic, and the structure of its knowledge base.
UNIT-IV	**Planning and Learning:** **Planning:** The blocks world, Components of Planning Systems, Goal stack Planning, Nonlinear planning, Hierarchical planning, Conditional planning, Planning problem, Analysis of planning approaches. **Learning:** Different learning approaches, Machine learning tasks: Classification, Supervised learning, unsupervised learning, Reinforcement learning, Inductive learning. Simple statistical-based learning, Single Layer & Multi-Layer Perceptron. **Case Study:** Self-Driving Cars: Discuss how companies like Tesla and Waymo utilize planning and learning algorithms to navigate and make decisions in real-time environment.

UNIT-V	**Natural Language Processing (NLP) and Expert Systems:** **NLP:** Language models, Text classification, Information retrieval, Semantic analysis. **Pattern recognition**- Speech recognition, Image transformation, low level processing, medium and high level processing, **Expert Systems:** Basic Components, Architecture of Expert systems, ES-Shells, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems, Communication in Expert systems. **Case Study:** **1.** IBM Watson: Explore Watson's use of NLP , its architecture, and its current applications in healthcare and other industries. Expert system in Education.

TEXT BOOKS

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

REFERENCE BOOKS

- Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI
- Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann, 1998.
- Biere, A., Heule, M., Van Maaren, H., Walsh, T., Handbook of Satisfiability, IOS Press, 2009.
- Judea Pearl, Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison- Wesley Publishing Company, 1984.
- 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)
- Kevin Murphy, Machine Learning: A Probabilistic Perspective (MLAPP), MIT Press, 2012
- Artificial Intelligence and Expert Systems – Import, 28 April 2020 by I. Gupta (Author), G. Nagpal (Author)

SOFTWARE ENGINEERING	
Course Code: 24**CS3004**	Continuous Evaluation: 40 Marks
Pre-Requisite : Concept of OOP and Methodology	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To analyse different software development process models.
2. To extract and analyse software requirements specifications for different projects.
3. To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects
4. To gain knowledge of the system analysis and design concepts.
5. To apply different testing and debugging techniques and analysis their effectiveness.

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 software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification.
2. Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.
3. Apply testing principles on software project and understand the maintenance concepts.
4. Identify risks, manage the change to assure quality in software projects.
5. Think critically about ethical and social issues in software engineering for different applications

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** 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.

UNIT-II	**SOFTWARE REQUIREMENTS & QUALITY ASSURANCE** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, 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.
UNIT-III	**SOFTWARE DESIGN CONCEPT** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.
UNIT-IV	**SOFTWARE TESTING** 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..
UNIT-V	**SOFTWARE MAINTENANCE & RELIABILITY ISSUES** 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.

TEXT BOOKS
• Richard Fairley, "Software Engineering Concepts", McGraw Hill, 2017
• Roger S. Pressman, "Software Engineering A Practitioner Approach" 4th edition , McGraw Hill, 1999
REFERENCE BOOKS
• Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000
• Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
• Shooman, Software Engineering, McGraw Hill, 1983.
• Fundamentals of Software Engineering by Rajib Mall, – PHI-3rd Edition, 2009
• The Software Engineer's Guidebook: Navigating Senior, Tech Lead, and Staff Engineer Positions at Tech Companies and Startups (Greyscale Indian Edition)- First Edition, 2023

BIG DATA ANALYTICS	
Course Code: 24CS3012	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE

1. To impart the basic concepts of analysis for growing data and its complexities.
2. To understand concepts about statistical analysis and inferential statistics.
3. To impart knowledge on various tools and technologies to manage and analyze the big data.
4. To illustrate knowledge management mechanism for better decision making.
5. To enable them to work on big data related applications and solve real world applications using tools such as Apache Hadoop.

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. Explain the motivation for big data systems and identify the main sources of Big Data in the real world and driver analysis of big data.
2. Demonstrate an ability to use analytics efficiently store retrieve and process Big Data for inferential analysis that will help in solving real world problems.
3. Implement several tools such as IBM Cognos to understand visual perception in a better way.
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data using Knowledge discovery mechanism.
5. Design an ecosystem to monitor and maintain the large number of files using big data tools Apache Hadoop.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Big Data and its importance, Four V's, Extended 4 to 6 V's, Drivers for Big data, Big data analytics, and Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.
UNIT-II	**STASTICAL ANALYSIS** 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, Power of a Statistical Test, Statistical versus Practical Significance, Effect Size, Meta-Analysis.
UNIT-III	**DATA VISUALIZATION** Meaning and significance, Traits of Meaning full Data, Brief History of Information Visualization, Power of visual perception, Making abstract data Visible, Building Blocks of information Visualization. Analytical Techniques, Using tool IBM Cognos for understanding data visualization.
UNIT-IV	**OLAP** Big Data, In-Memory Processing, limitations of In Memory Processing. Big Data Privacy, Big data Visualization, Map Reduce algorithm, OLAP and its applications, Data Mining Process, Knowledge Discovery, Decision Support Systems.
UNIT-V	**APACHE HADOOP** 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

- Stephen Few, "Now You See It: Simple Visualization Techniques for Quantitative Analysis" Publisher: Jonathan G Koomey
- Frank J. Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money Publisher: Wiley.

REFERENCE BOOKS

- Gelman, Andrew, and Jennifer Hill. Data Analysis Using Regression and Multilevel/Hierarchical Models. 1st ed. Cambridge, UK: Cambridge University Press, 2006. ISBN: 9780521867061.
- Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. Bayesian Data Analysis. 2nd ed. New York, NY: Chapman & Hall, 2003. ISBN: 9781584883883.
- Big Data for Dummies by Judith Hurwitz (Author), Alan Nugent (Author), Fern Halper (Author), Marcia Kaufman (Author) – 2013
- Simple Visualization Techniques for Quantitative Analysis-Stephen Few , Analytics Press; First Edition (1 April 2009)

ARTIFICIAL INTELLIGENCE LAB	
Course Code: 24CS3114	Continuous Evaluation: 60 Marks
Pre-Requisite : Basics of any Programming Language	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES (CO)

1. To implement concepts of AI through different programming languages.
2. To understand the role of each component of AI in designing a smart application.

COURSE LEARNING OUTCOMES (CLO)

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

1. Understand the requirement of search strategies in AI.
2. Understand and implement the concepts for uncertainty, knowledge representation and learning.
3. Learn to design the application while deciding the level of requirement of each AI component (search, Planning, Learning, uncertainty).
4. Learn and understand the mapping and interaction among various AI components for an automated/ smart application.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**
CO1	√	√		
CO2			√	√

LIST OF PROGRAMS

1. WAP to solve Water Jug Problem (Using DFS and BFS).
2. WAP to solve a problem for Means-End Analysis technique (like robot traversal)
3. WAP to solve 4-Queen's Problem and 5-Queen's Problem.
4. WAP to solve travelling salesman problem.
5. WAP to convert Predicate To Prepositional Logic
6. WAP for Syntax Checking of English sentences-English Grammar.
7. WAP to develop an Expert system for Medical diagnosis.
8. Develop any Rule based system for an application of your choice.
9. WAP to study various fuzzification methods in fuzzy logic.
10. Design fuzzy rule base system for tipping problem
11. WAP to design a single layer perceptron for linear logic gates.

12. WAP to design multi-layer perceptron for non-linear logic gates.

13. Design a classifier for fruit classification using Bayesian and Decision Tree classifier.

14. Develop an algorithm for morphological derivation / verb derivation and implement it.

Note:

1. **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.
2. **Students will create a project in teams to analyse and apply the concepts learnt.**

Learning Resources	
Reference Book and other materials	1. Laboratory Manual 2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Fourth edition, 2020. 3. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill.

SOFTWARE ENGINEERING LAB	
Course Code: **24CS3118**	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 modelling 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.

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. Prepare SRS document, design document, test cases and software configuration management and risk management related document.
2. Develop function oriented and object oriented software design using tools like rational rose.
3. Generate a high-level design of the system from the software requirements
4. Have experience and/or awareness of testing problems and will be able to develop a simple testing report

MAPPING BETWEEN COURSE OBJECTIVES (COS) AND COURSE LEARNING OUTCOMES

CLOS\CO	CLO1	CLO2	CLO3	CLO4
Co1	√	√		
CO2			√	√

LIST OF EXPERIMENTS

Structure Diagram:

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

Behavior Diagram:

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

Interaction Diagram:

7. Sequence Diagram – To display the time sequence of objects interactions.
8. Communication Diagram – To display the elements of frame, lifeline, messages.

Case Study :

9. UML interaction overview diagram for online shopping
10. Bank ATM behavioral using state machine diagram
11. Library Domain model using Class diagram

TEXT BOOKS

1. Roger S. Pressman, "Software Engineering A Practitioner Approach" 4th edition , McGraw Hill, 1999
2. Software Engineering- Sommerville, 7th edition, Pearson Education
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education

REFERENCE BOOKS

1. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.
2. K.K. Aggarwal & Yogesh Singh, ―Software Engineering‖, New Age International, 2005
3. Pankaj Jalote, ―An Integrated Approach to Software Engineering‖, Second Edition, Springer.

Software are :-

1. Stare UML, Lucid chart , etc.

Learning Resources	
Reference Book and other materials	**1.** Laboratory Manual

LIVE PROJECT-III & INDUSTRIAL VISIT	
Course Code: 23CS0304	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 site 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 a first-hand experience on sites.
- Apply the concepts learnt to design and create a application.

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

	CLO1	**CLO2**
CO1	√	√

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: 24CS4003	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 students to the foundational concepts of cloud computing, including its history, architecture, characteristics, service models, deployment models, and advantages compared to traditional computing paradigms.
2. To provide a comprehensive understanding of virtualization techniques, their benefits and drawbacks, and their role in cloud computing, including the management of virtual infrastructures and service-oriented architectures.
3. To equip students with the skills to develop cloud-native applications, leveraging microservices architecture, DevOps practices, cloud SDKs, APIs, and various cloud services for database management, scaling, monitoring, and serverless computing.
4. To understand the process of migrating applications and services to the cloud, including challenges, legal issues, cloud economics, and capacity management strategies.
5. To provide an in-depth understanding of the security protocols, algorithms, and tools used to secure data in cloud environments, addressing the unique security concerns and legal issues associated with multi-tenant and multi-cloud architectures.

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 history and evolution of cloud computing and explain the essential characteristics and architecture of cloud computing.
2. Explain virtualization techniques and their importance in cloud computing.
3. Understand the principles of cloud-native application development and implement microservices architecture in cloud applications.
4. Identify the key challenges associated with cloud migration and discuss the legal issues related to cloud computing.
5. Utilize tools and technologies to secure data in both private and public cloud architectures.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Cloud computing history, architecture and essential characteristics, cloud service models, Cloud Deployment models, advantages of cloud computing, cloud v/s grid computing.
UNIT-II	**VIRTUALIZATION** 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.
UNIT-III	**CLOUD APPLICATION DEVELOPMENT** **Cloud-Native Development:** Principles of Cloud-Native Applications, Microservices Architecture, DevOps and Continuous Integration/ Continuous Deployment (CI/CD). **Developing with IaaS and PaaS:** Setting Up Development Environments, Utilizing Cloud SDKs and APIs, Deployment Strategies. **Database Services:** Managed Databases (SQL, NoSQL), Database Migration, Performance Optimization. **Application Scaling and Monitoring:** Auto-Scaling, Load Testing, Monitoring and Logging. **Serverless Architecture:** Introduction to Serverless, Building and Deploying Serverless Applications, Use Cases and Best Practices
UNIT-IV	**MIGRATING INTO THE CLOUD:** 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.
UNIT-V	**CLOUD SECURITY** 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.
• Cloud Computing Web-Based dynamic IT services: Christian Baun, Springer.
• Barrie Sosinky, Cloud Computing: Bible, 1st edition, Wiley Publishing, Inc., 2011.

REFERENCE BOOKS
• Syed A.Ahson and Mohammed Ilyas, Cloud Computing and Software Services: Theory and Techniques, CRC Press, Taylor and Francis Group, 2010.
• Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Cloud Computing for Dummies.Wiley- India edition, 2010

Course Code: 24CS4005	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 a strong foundation in HTML, enabling students to create and structure web content effectively.
2. To enable students to style and layout web pages using CSS effectively, making them visually appealing and responsive.
3. To introduce students to JavaScript for dynamic web functionality and React for building interactive user interfaces.
4. To teach students server-side programming with Node.js and Express, enabling them to build and manage backend services and APIs.
5. To integrate the knowledge gained from previous units to build complete web applications and deploy them to production environments.

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 a personal portfolio webpage and build a multimedia gallery with images, audio, and video. 2. Style the personal portfolio webpage and Create a responsive web page layout using Flexbox and CSS Grid. 3. Build a dynamic to-do list application using vanilla JavaScript and a simple React application with multiple components and routing. 4. Build a full-stack application with React frontend and Node.js backend. 5. Develop and deploy a full-stack web application.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
CO1	√					
CO2		√				
CO3			√			
CO4				√	√	
CO5						√

COURSE CONTENTS

UNIT NUMBER	**COURSE CONTENTS**
UNIT-I	**Fundamentals of Web:** Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. **Introduction to HTML:** What is HTML?HTML Document Structure, HTML Tags, Elements, and Attributes. **Basic HTML Elements:** Headings, Paragraphs, and Text Formatting, Lists (Ordered, Unordered), Links and Anchors. **HTML Multimedia:** Images, Audio and Video Embedding. **HTML Forms:** Form Elements (input, textarea, select, button), Form Attributes and Validation, **HTML5 Features:** Semantic Elements (header, footer, article, section), New Form Elements and Attributes, Canvas and SVG for Graphics.

UNIT-II	**CSS:** Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box model, Background images, Responsive Designs. **JAVASCRIPT:** Overview of JavaScript, Object orientation and JavaScript, General syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructor, Pattern matching using regular expressions, Errors in scripts, Examples
UNIT-III	**Javascript and HTML Documents:** The JavaScript execution environment; Dynamic Documents with Javascript, **DOM Manipulation:** Selecting and Modifying Elements, Event Handling, Form Validation. **ES6 Features:** Let and Const, Template Literals, Destructuring, Modules and Imports/Exports. **Introduction to React:** What is React? Setting up a React Environment (using Create React App), Components, Props, and State. **React Components:** Functional vs. Class Components, Lifecycle Methods, and Handling Events. **React Hooks:** useState and useEffect, Custom Hooks. **React Router:** Setting Up React Router, Navigation and Routing. **State Management:** Context API, Introduction to Redux (optional)
UNIT-IV	**Introduction to Node.js:** What is Node.js?, Setting Up Node.js Environment, Node.js Modules and NPM. **Basic Node.js:** Creating a Simple Server, Reading and Writing Files, Handling Asynchronous Code (Callbacks, Promises, Async/Await). **Express Framework:** Setting Up Express, Middleware and Routing, Handling Requests and Responses. **Building RESTful APIs:** CRUD Operations, Connecting to a Database (e.g., MongoDB), Authentication and Authorization. **Advanced Node.js:** Error Handling, Deployment (Heroku, AWS), Real-Time Communication (Socket.io)
UNIT-V	**Full-Stack Application Development:** Project Structure and Workflow, Connecting Frontend to Backend, State Management across the Stack. **Version Control with Git:** Git Basics and Commands, Branching and Merging, Collaborating on Projects. **Testing and Debugging:** Writing Unit Tests (Jest, Mocha), Debugging Techniques and Tools. **Build Tools and Automation:** Webpack and Babel, Task Runners (Gulp, Grunt). **Deployment and Maintenance:** Preparing for Deployment, Deployment Platforms (Heroku, Netlify, AWS), Continuous Integration and Deployment (CI/CD)

TEXT BOOKS

- Head First Servlets and JSP Book, Kathy Sierra
- Java server programming, Kathy walrath
- Programming the World Wide Web – Robert W. Sebesta, 8th Edition, Pearson Education, 2015.
- Internet & World Wide Web How to program – M. Deitel, P.J Deitel, A. B. Goldberg,

3rd Edition, Pearson Education / PHI, 2004.

REFERENCE BOOKS

- STRUTS 2 IN ACTION Book Chad Michael Davis Donald J. Brown, Scott Stanlick
- Hibernate, Jeff Linwood Dave Minter
- The Web Warrior Guide to Web Programming – Xue Bai et al,

CLOUD COMPUTING LAB	
Course Code: 23CS4113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

1. To analyse and reveal the core issues in line with the security, privacy, and interoperability in cloud platform.
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 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)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**	**CLO7**	**CLO8**
CO1	√	√						
CO2		√	√					
CO3			√	√				
CO4				√				
CO5					√	√		
CO6							√	√

LIST OF PROGRAMS

1) To study of Cloud Computing & Architecture and types of Cloud Computing.
2) To create and run virtual machines on open source OS.
3) To implement Infrastructure as a Service, Installing OpenStack and use it as Infrastructure as a Service.
4) To install Storage as Service. [Installation and understanding features of ownCloud as SaaS.]
5) To implement identity management. [installing and using identity management feature of OpenStack]
6) To write a program for web feed [PHP, HTML]
7) To simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
8) To install Hadoop single node cluster and run simple applications like wordcount.
9) To find a procedure to transfer the files from one virtual machine to another virtual machine.
10) Install Google App Engine. Create hello world app and other simple web applications using python/java.
11) Working of Goggle Drive to make spreadsheet and notes.
12) Installation and Configuration of Justcloud.
13) Working in Cloud9 to demonstrate different language.
14) Working in Codenvy to demonstrate Provisioning and Scaling of a website.
15) Installation and Configuration of Hadoop/Eucalyptus

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

TEXT BOOKS
• Cloud Computing-A Practical Approach" Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw-Hill.
• Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'ReillyMedia Inc.
• Barrie Sosinky, Cloud Computing: Bible, 1st edition, Wiley Publishing, Inc., 2011.

REFERENCE BOOKS
• Syed A.Ahson and Mohammed Ilyas, Cloud Computing and Software Services: Theory and Techniques, CRC Press, Taylor and Francis Group, 2010.
• Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Cloud Computing for Dummies.Wiley- India edition, 2010

LIVE PROJECT-III & INDUSTRIAL VISIT	
Course Code: 23CS4115	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 site 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 a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

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

	CLO1	**CLO2**
CO1	√	√

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.

MINOR PROJECT	
Course Code: 23CS4117	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 impact adequate training so that confidence to face and tackle any problem in the field is developed.

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. Identify, formulate and analyse existing problem 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)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√	√	√	√	√

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. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as a project work. Alternately, 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: 23CS4114	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 OUTCOME:

1. Identify, formulate and analyse existing problem 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	√	√	√	√	√

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. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as a project work. Alternately, 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

COMPUTER ARCHITECTURE & ORGANIZATION	
Course Code: 24CSPE2007	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To impart the basic concepts of component, architecture and register organization.
2. To understand concepts of data representation and binary value implementation using arithmetic algorithms.
3. To teach the students how to describe machine capabilities and design an effective data path of control unit
4. To provide knowledge of memory technologies, interfacing techniques and sub-system.
5. To make students understand the importance of IO interfacing techniques and their performance metrics for a typical computer.

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. Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.
2. Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.
3. Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.
4. Understand the need for an interface and instruction cycle phases. Implement the hardwiredand microprogrammed control unit for analyse the performance.
5. Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Evolution of Computer Systems-Computer Types-Functional units-Basic operational concepts-Bus structures- location and addresses-memory operations-Addressing modes-Design of a computer system- Memory Instruction and instruction sequencing, RISC versus CISC.
UNIT-II	**CENTRAL PROCESSING UNIT** Introduction-Arithmetic Logic Unit - Fixed point arithmetic, floating point arithmetic-Execution of complete instruction-Basic concepts of pipelining.
UNIT-III	**CONTROL UNIT DESIGN** Introduction-Control Transfer-Fetch cycle- Instruction Interpretation & Execution,Hardwired control- Micro-programmed control
UNIT-IV	**MEMORIES AND SUBSYSTEMS** Semiconductor memory - Static and Dynamic -Associative memory- Cache memory-Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms Virtual memory-Secondary memories-Optical magnetic tape & magnetic disks &controllers.
UNIT-V	**I/O PROCESSING** Introduction-Data transfer techniques- Bus Interface- I/O Channel-I/O Processor, I/Odevices -Direct memory access.

TEXT BOOKS
• Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, • Computer System Architecture, Morris Mano, Third edition, Pearson publications. • Computer Organization and Architecture – Designing for Performance", William Stallings, Ninth edition, Pearson publications.
REFERENCE BOOKS
• Structured Computer Organization, Andrew S. Tanenbaum
• David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface".
• John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24**CSPE2008**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To analyze the asymptotic performance of algorithms and to write rigorous correctness proofs for algorithms.
2. To demonstrate a familiarity with major Divide and conquer algorithms and data structures.
3. To apply important Dynamic programming design paradigms and methods of analysis.
4. To demonstrate through examples greedy design paradigm.
5. To Synthesize efficient algorithms in common engineering design situations

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. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
3. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

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

CO's \ CLO's	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** **Algorithm analysis:** Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – **searching:** linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. **Sorting:** Insertion sort – heap sort.
UNIT-II	**GRAPH ALGORITHMS** **Graph algorithms:** Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm **Network flow:** Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.
UNIT-III	**ALGORITHM DESIGN TECHNIQUES** **Divide and Conquer methodology:** Finding maximum and minimum - Merge sort - Quick sort **Dynamic programming:** 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 Trees.
UNIT-IV	**STATE SPACE SEARCH ALGORITHMS** **Backtracking:** 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
UNIT-V	**NP-COMPLETE AND APPROXIMATION ALGORITHM** **Tractable and intractable problems:** Polynomial time algorithms – Venn diagram representation -NP-algorithms - NP-hardness and NP-completeness– Bin Packing problem - Problem reduction: TSP – 3-CNF problem. **Approximation Algorithms:** TSP - **Randomized Algorithms:** concept and application - primality testing - randomized quick sort - Finding kth smallest number

TEXT BOOKS

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
- Richard Johnsonbaugh , Marcus Schaefer , " *Algorithms* " , Pearson Education, 2006 3rd edition

REFERENCE BOOKS

- Aho, Ullman & Hopcraft, "*The Design and Analysis of Algorithms*", Pearson Education, 2001
- S.E.Goodman , S.T.Hedetniemi , "*Introduction to the Design and Analysis of Algorithms*", McGraw Hill , 2002
- Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
- Sara Baase , "*Computer Algorithms - Introduction to design and analysis",* Pearson.
- S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 24CSPE2118	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

1. To understand and apply the algorithm analysis techniques on searching and sorting algorithms.
2. To critically analyze the efficiency of graph algorithms.
3. To understand different algorithm design techniques.
4. To solve programming problems using state space tree.
5. To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

COURSE LEARNING OUTCOMES (CLO's)

The syllabus adhere 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:

1. Analyze the efficiency of algorithms using various frameworks.
2. Apply graph algorithms to solve problems and analyze their efficiency.
3. Implement various techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
4. Analyze & Use the state space tree method for solving problems.
5. Apply problems solving using approximation algorithms and randomized algorithms.

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

CO \ CLO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

LIST OF EXPERIMENT:

1. Write a program to Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
3. Develop a program to implement graph traversal using Breadth First Search.
4. Develop a program to implement graph traversal using Depth First Search.
5. Develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
8. Write a program to perform Quick Sort for the given list of integer values.
9. Write a Program to perform Merge Sort on the given two lists of integer values.
10. Implement N-Queens problem using Backtracking.
11. Write a program to solve Sum of subsets problem for a given set of distinct numbers.
12. Implement fractional knapsack problem using Greedy Strategy.
13. Implement Travelling Salesman Problem.
14. Implement randomized algorithms for finding the k^{th} smallest number.

TEXT BOOK:

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
- Richard Johnsonbaugh, Marcus Schaefer, " Algorithms ", Pearson Education, 2006 3rd edition

REFERENCE BOOKS

- Aho, Ullman & Hopcraft, "The Design and Analysis of Algorithms", Pearson Education, 2001
- S.E.Goodman, S.T.Hedetniemi, "Introduction to the Design and Analysis of Algorithms", McGraw Hill , 2002
- Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
- Sara Baase, "Computer Algorithms - Introduction to design and analysis", Pearson.
- S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

COMPUTER NETWORKS	
Course Code: 24CSPE3003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
1. To study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model 2. To study data link layer concepts, design issues, and protocols. 3. To gain core knowledge of Network layer routing protocols and IP addressing. 4. To study Session layer design issues, Transport layer services, and protocols. 5. To acquire knowledge of Application layer and Presentation layer paradigms and 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 the functions of each layer in OSI and TCP/IP model.
2. Describe the functions of data link layer and explain the protocols.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Describe the Session layer design issues and Transport layer services.
1. Explain the functions of Application layer and Presentation layer paradigms and Protocols.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION Internet**: 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. **Physical Layer** – 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.
UNIT-II	**DATA LINK LAYERS** Data link Layer design issues: Framing, Error Detection & 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;
UNIT-III	**NETWORK LAYERS PROTOCOLS** IPV4 Addressing – classful and classless, Network Address Translation, IPV4 Packet format- IPV6 Addressing, IPV6 Packet format; ARP, RARP, DHCP, ICMP and IGMP.
UNIT-IV	**NETWORK ROUTING** LAN interconnecting devices: Hubs, Switches, Bridges, Routers, Gateways; Routing andForwarding, Routing Table, Intra- and inter-domain routing, Distance vector routing, DVR Instability problem and solutions, RIP, Link State Routing, OSPF, Path Vector Routing, BGP; Virtual Private Networks; Routing-Link State and Distance Vector Routing Protocols- Implementation-Performance Analysis- Packet Tracer TCP and UDP-Congestion Control-Effects of Congestion-Traffic Management-TCP Congestion Control-Congestion Avoidance Mechanisms-Queuing Mechanisms-QoS Parameters. ;
UNIT-V	**TRANSPORT & APPLICATION LAYER** Transmission Control Protocol; User Datagram Protocol; Congestion control mechanisms; Application Layer: Email – SMTP, POP, IMAP; FTP, NNTP, HTTP, DNS, WWW , Firewall.

TEXT BOOKS

- Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005

REFERENCE BOOKS

- Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.
- James F. Kurose and Keith W. Ross, "Computer Networking:A Top-Down Approach Featuring the Internet", Pearson Education, Third Edition 2003.
- William Stallings, "Data and Computer Communication", Seventh Edition, Pearson Education, 2003.

COMPUTER NETWORKS LAB	
Course Code: 24CSPE3113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To learn about packet sniffing.
2. To observe and explore various network protocols by "seeing them in action".
3. To learn about client server programming approach for network communication.

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 and learn how to determine the network statistics of their machines.
2. Learn about the working of a packet sniffer that is Wireshark.
3. Understand the in-depth working and role of network protocols.
4. Design and understand the working of TCP three way handshaking protocol.
5. Design and understand UDP based applications.

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

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√	√			
CO2			√		
CO3				√	√

LIST OF PROGRAMS

1 Study of Basic Network Commands, Demo session of all networking hardware and Functionalities .
2 Observing Packets across the network and Performance Analysis of Routing protocols
3 Basic Router Configuration (Creating Passwords, Configuring Interfaces)
4 Flow control mechanisms
5 Implementing an IP Addressing Scheme
6 Simulation of Transport layer Protocols and analysis of congestion control techniques in network
7 Develop a DNS client server to resolve the given host name or IP address.
8 Single-Area OSPF and Multi-Area Link Costs and Interface.
9 Configuring WEP on a Wireless Router
10 Configuring Ethernet and Serial Interfaces
11 Planning Network-based Firewalls 25 Configuring a Cisco Router as a DHCP Server

Note:

Students can use any programming language for writing the programs. 5 or more exercises can be given by the Faculty.

TEXT BOOKS

4. Andrew S. Tanenbaum, "Computer Networks", Pearson Fourth Edition, 2005.
5. Computer Networking: A Top-Down Approach Featuring the Internet, 5th Ed. (2010), by James F. Kurose and Keith W. Ross. Covers similar material to Peterson and Davie.

REFERENCE BOOKS

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.

OPTIMIZATION TECHNIQUES	
Course Code: 24CSPE3027	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To identify and develop operational research models from the verbal description of the real system.
2. To understand the mathematical tools that are needed to solve optimisation problems.
3. To use mathematical models of sequencing and replacement problems.
4. To impart knowledge in concepts and tools of Inventory control.
5. To develop a report that describes the queue model and the solving technique, analyse the results and propose recommendations.

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 usage of linear programming and Simulation for Solving Business Problems.
2. Conduct and interpret the assignment and transportation problems.
3. Identify the optimal sequence and best age of replacement.
4. Explain the meaning of Inventory control, various forms and functional role of Inventory.
5. Able to explain the applications of queue models in real life.

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

CLO / CO	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓				
CO 2		✓			
CO 3			✓		
CO 4				✓	
CO 5					✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**LINEAR PROGRAMMING** Introduction: Operations research and decision making, Types of mathematical models and constructing the model, Formulation of linear programming problem, Graphical Method, Simplex method
UNIT-II	**ASSIGNMENT & TRANSPORTATION MODELS** Assignment models, Transportation problem, North west corner method. Least cost method, Vogel's approximation method – Modi method, Unbalance and degeneracy in transportation model
UNIT-III	**SCHEDULING AND REPLACEMENT PROBLEMS** 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.
UNIT-IV	**INVENTORY CONTROL** Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with and without shortages.
UNIT-V	**PRINCIPLES OF QUEUEING THEORY** Introduction: Queues and their characteristics, Queueing Models with Markovian Input and Markovian Service, M/M/1 & M/M/C Queueing Models.

TEXT BOOKS
• Sharma, S. D. 2015, Operations Research, Theory Methods & Applications, Kadar Nath Ram Nath, Delhi.
• Taha, H. A. 2007, Operations Research, 8th edn, Pearson.
• Winston, W. L. 2004, Operations Research: Applications and Algorithms, 4th edn, Thomson.
REFERENCE BOOKS
• Rader, D. J. 2010, Deterministic Operations Research: Models and Methods in Linear Optimization, J. Wiley & Sons.
• Williams, H. P. 2013, Model Building in Mathematical Programming, 5th edn, Wiley
• Schrage, L. 1997, Optimization Modeling with LINDO, 5th edn, Thomson.

DISTRIBUTED DATABASE	
Course Code: 24CSPE3035	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 quey 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 system.
6. Understand the design aspects of object-oriented database system and related development.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design:

UNIT NUMBER	COURSE CONTENTS
	Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.
UNIT-II	**QUERY PROCESSING AND DECOMPOSITION** 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.
UNIT-III	**TRANSACTION MANAGEMENT** Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & 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
UNIT-IV	**DISTRIBUTED DBMS RELIABILITY** Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & 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.
UNIT-V	**DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS** 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.

TEXT BOOKS

- M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
- Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

REFERENCE BOOKS

- Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition
- Silberschatz, A., Korth, H. F., and Sudarshan, S. Database System Concepts, McGraw-Hill, 7th Edition. 2019

COMPUTER GRAPHICS	
Course Code: 23**CSPE3019**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE

1. To gain knowledge about graphics hardware devices and software used.
2. To identify various graphical algorithms to construct graphical primitives.
3. To understand and evaluate the two dimensional, three dimensional graphics and their transformations and viewing techniques.
4. To be familiar with clipping techniques and to appreciate illumination and color models
5. To develop graphical programs for multidisciplinary environment.

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. Illustrate the fundamentals of computer graphics hardware and software concepts.
2. Design two dimensional and three dimensional graphics and apply three dimensional transformations.
3. Demonstrate and Apply clipping techniques to graphics.
4. Apply algorithms on different graphical models
5. Apply Illumination and color models and design animation sequences.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√				
CO2		√	√	√	
CO3		√			
CO4			√	√	√
CO5				√	

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO COMPUTER GRAPHICS** What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, Two dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's; Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, mid-point circle drawing algorithm; Filled area algorithms: Scanline: Polygon filling algorithm, boundary filled algorithm.
UNIT-II	**TWO/THREE DIMENSIONAL VIEWING** The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms):- 4 bit code algorithm, Sutherland-

UNIT NUMBER	COURSE CONTENTS
	cohen algorithm, parametric line clipping algorithm (Cyrus Beck).
UNIT-III	**CLIPPING & TRANSFORMATION** Polygon clipping algorithm: Sutherland - Hodgeman polygon clipping algorithm. Two dimensional transformations: transformations, translation, scaling, rotation, reflection, composite transformation. Three dimensional transformations: Three dimensional graphics concept, Matrix representation of 3-D Transformations, Composition of 3-D transformation.
UNIT-IV	**VIEWING IN 3D** Projections, types of projections, the mathematics of planner geometric projections, coordinate systems. Hidden surface removal: Introduction to hidden surface removal .Z- buffer algorithm, scanline algorithm, area sub-division algorithm.
UNIT-V	**REPRESENTING CURVES AND SURFACES** Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method. Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency.

TEXT BOOKS

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

REFERENCE BOOKS

- Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
- Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition
- Fundamentals of 3Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.
- Computer Graphics: Secrets and Solutions by Corrign John, BPB
- Graphics, GUI, Games & Multimedia Projects in C by Pilania & Mahendra, Standard Publ.

SYSTEM MODELING AND SIMULATION	
Course Code: 24**CSPE3021**	Continuous Evaluation: 40 Marks
Pre-Requisite : Mathematics, Computer Networks, Java	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE (CO)
1. To understand various mathematical models, simulation techniques and its applications.
2. To Review basic simulation methods and principles applied to the architecting and engineering of complex systems.
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.
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.
5. To develop simulation term projects that address critical research issues and/or industrial applications in systems architecting and engineering.

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. Remember and understand the concepts of system and environment. 2. Understand and apply the concepts of statistics in simulation. 3. Apply and analyze how random numbers can be used for simulation and modelling. 4. Evaluate the concepts of simulation and modelling on test data. 5. Create and explore the applications of simulation.

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

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

COURSE CONTENTS

UNIT	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Systems & Environment – Discrete & 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.
UNIT-II	**STATISTICAL MODELS** Statistical models – Discrete & Continuous distributions – Poisson process; Queuing models – Characteristics – notations; long 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
UNIT-III	**RANDOM NUMBERS** 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.
UNIT-IV	**ANALYSIS OF SIMULATION DATA** 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.
UNIT-V	**SIMULATION AND SIMULATION APPLICATIONS** 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. **Case Studies and Applications** 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, 2nd 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.

DIGITAL IMAGE PROCESSING	
Course Code: 24CSPE3023	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 given image using various feature extraction algorithms in order to recognize object.
6. Demonstrate the use of MATLAB to create interactive image processing applications.

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

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	√					
CO2		√				
CO3			√	√		
CO4				√		
CO5					√	
CO6					√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** Origin of Digital Image processing – fundamental steps – Components of Image processing system – Visual perception, Perspective Projection – Light and EM spectrum – Image sensing and acquisition – Image sampling and Quantization – relationship between pixels.
UNIT-II	**IMAGE ENHANCEMENT** Spatial Domain: Gray level transformation – Histogram processing – Arithmetic / Logic operations, Correlation and Convolution- Spatial filtering – smoothing filters – sharpening filters Frequency Domain: 2D sampling, Fourier transform – smoothing frequency domain filters – sharpening filters – Homographic filtering
UNIT-III	**IMAGE RESTORATION** Model of Image degradation/ restoration process –Noise characterization- Noise models – mean filters – adaptive filters – band reject – bandpass – notch – optimum notch filters – Linear, position invariant degradations – establishing degradation functions – Inverse filtering –Geometric mean filters- Restoration from projections
UNIT-IV	**IMAGE COMPRESSION** Fundamentals – Image compression models – Types of Redundancies-Information theory – error free compression: variable length – LZW – Bitplane – Lossless predictive coding; Lossy compression: Lossy predictive – transform – wavelet coding; Image compression standards. Deep learning for image processing, Image processing in augmented reality and virtual reality
UNIT-V	**IMAGE SEGMENTATION, REPRESENTATION & DESCRIPTION** Segmentation: Detection of discontinuities – Edge linking & Boundary detection – Thresholding – region based segmentation Representation & Description: Chain codes – Polygonal approximations – signatures – Boundary segments – Skeletons; Boundary Descriptors – Regional descriptors
UNIT-VI	**PROJECT** Research Activities and hands-on experience to solve complex real-world problems using any image processing library function. Tools: MATLAB or Octave Python with libraries such as OpenCV, scikit-image, and NumPy.

TEXT BOOKS
• Rafael C. Gonzalez, Richard E. Woods, "*Digital Image Processing*" , 2nd edition , Pearson Education, 2007.
• S. Annadurai, R. Shanmugalakshmi, "*fundamentals of Digital Image Processing*", Pearson Education, 2007

REFERENCE BOOKS
• Rafael C. Gonzalez, Richard E. Woods, Eddins, "*Digital Image Processing using MATLAB*" , Pearson Education, 2005
• Anil Jain K. "*Fundamentals of Digital Image Processing*", PHI, 1999
• William Pratt , "*Digital Image Processing*", Wiley Inderscience, 2nd edition 1991

VISUAL PROGRAMMING	
Course Code: 23CSPE3025	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVES

1. To identify and use the features of a Visual Basic (VB) development environment.
2. To use the properties and methods of forms and controls to design VB applications.
3. To write procedures to perform input, processing, and output.

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. Understands the visual programming concepts and can explain basic concepts and definitions.
2. Create programs that use decisions and repetition and Write statements that use various mathematical operators.
3. Design the front end or Graphical User Interface for any application.
4. Link the front end with the back-end and create an interactive environment.

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

	CLO1	CLO2	CLO3	CLO4
CO1	√	√		
CO2			√	
CO3				√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	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.
UNIT-II	Basics of Programming: 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-III	Programming with VB: 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	Programming with VB: 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	Working with forms and menus : 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

- Steven Holzner, "Visual Basic 6 Programming: Black Book", Dreamtech Press.
- Evangelos Petroutsos. "Mastering Visual Baisc 6", BPB Publications.
- Michael Halvorson, "Step by Step Microsoft Visual Basic 6.0 Professional", PHI
- Visual basic 6 Complete", BPB Publications.

REFERENCE BOOKS

- Scott Warner, "Teach Yourself Visual basic 6", Tata McGraw-Hill Edition
- Brian Siler and Jeff Spotts, "Using Visual Basic 6", Special Edition, PHI.
- Julia Case Bradley & Anita C. Millspaugh, "Programming in Visual Basic 6.0"

PRINCIPLES OF PROGRAMMING LANGUAGES	
Course Code: 24**CSPE3033**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T 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**
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**PRELIMINARY CONCEPTS** 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
UNIT-II	**Lambda Calculus and Turing Machines:** Equivalence of Lambda calculus and Turing machines, free and bound variables, substitutions.**Type Theory:** Operational semantics, basic type systems and type soundness, advanced type systems.
UNIT-III	**Language Design and Implementation** Principles of language design, Domain-specific languages (DSLs), Scripting languages vs. system languages , Case studies of language design (Python, Rust, Swift)
UNIT-IV	**FUNCTIONAL & CONCURRENT PROGRAMMING** 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) **Concurrent Programming:** Threads, processes, synchronization monitors, concurrent objects, concurrent programming in Java/MPI/CILK
UNIT-V	**LOGIC PROGRAMMING** 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/REFERENCE BOOKS

- Sethi, R., "Programming Languages: Concepts and Constructs", Pearson Education.2004
- Tucker, A. and Noonan, R., "Programming Languages: Principles and Paradigms", Tata McGraw-Hill.2007
- Van Roy, P. and Haridi, S., "Concepts, Techniques and Models of Computer Programming", Prentice-Hall of India.

REFERNCE BOOKS

- Programming Language Pragmatics. Michael Scott, Morgan Kaufmann, 2000.
- Essentials of Programming Languages. Friedman, Wand and Haynes, Prentice-Hall International (PHI), 1998.
- Principles of Programming Languages. Tennant. PHI, 1981.
- Benjamin Pierce, Types and Programming Languages, MIT Press, 2002.
- David Watt, Programming Language Design Concepts, Willey, 2004.
- Kenneth Louden, Programming Languages: Principles & Practice,Thomson, 2003
- "Concepts of Programming Languages" by Robert W. Sebesta (12th Edition, 2019, Pearson)

THEORY OF APP DEVELOPMENT	
Course Code: 23CSPE3037	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE
1. To facilitate students to understand android SDK.
2. To help students to gain a basic understanding of Android application development.
3. To inculcate working knowledge of Android Studio development tool.
4. To enable students to have skills that will help them to build their own Android application and publish it at the Google Play store.

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 various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2	√	√			
CO3			√	√	
CO4				√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO ANDROID:** Fundamentals of Java for Android Application Development, Overview of Android, Developing Spectacular Android Applications, Your First Android Project, Using Activities, Fragments and Intents in Android, Creating the User Interface, Coding Your Application, Understanding Android Resources, Turning Your Application into an App Widget
UNIT-II	**ANDROID APPLICATION DESIGN ESSENTIALS:** Designing the Tasks Application, Creating the Task Detail Page, Handling User Input, Getting Persistent with Data Storage, Updating Status Bar, Handling Pictures and Menus with Views, Emailing and Networking in Android, Working with Location Services and Maps, Working with Graphics and Animation, Audio, Video and Camera
UNIT-III	**ANDROID USER INTERFACE DESIGN ESSENTIALS:** Reminding the User, Working with Android Preferences, Developing for Tablets, Supporting Older Versions of Android. Drawing and working with Animations.
UNIT-IV	**TESTING ANDROID APPLICATIONS:** Testing the self-developed Android application, Publishing Your App to the Google Play Store, Monetizing and Distributing Android Applications. Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources
UNIT-V	**USING COMMON ANDROID APIS:** Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.
UNIT-VI	**PROJECT** Research Activities and hands-on experience to design Android Application and publish it on Google play.

TEXT BOOKS

- Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
- Pradeep Kothari, "Android Application Development: Black Book", Dreamtech Press, 1st Edition.

REFERENCE BOOKS

- Bill Phillips and Brian Hardy, "Android Programming: The Big Nerd Ranch Guide", Big Nerd Ranch Guides, 2nd Edition.
- Jesse Feiler, "IOS App Development for Dummies", Wiley, 1st Edition.

BLOCK CHAIN	
Course Code: 23CSPE3039	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE
1. To familiarise the functional/operational aspects of cryptocurrency ECOSYSTEM.
2. To understand emerging abstract models for Block chain Technology.
3. To identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain.

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 and learn how bitcoin and other coins work in real world.
2. Understand how cryptography primitives drive blockchains and crypto-currency infrastructures.
3. Understand how cryptocurrency and blockchains will move for future directions (ex. Privacy, multiparty computation, anonymity).

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

	CLO1	CLO2	CLO3
CO1	√		
CO2		√	
CO3			√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**CONSENSUS** The consensus problem, Asynchronous Byzantine Agreement , AAP protocol and its analysis, Nakamoto Consensus on permission-less, nameless, peer-to-peer network, Abstract Models for BLOCKCHAIN : GARAY model, RLA Model, Proof of Work (PoW) as random oracle, formal treatment of consistency, liveness and fairness, Proof of Stake (PoS) based Chains, Hybrid models (PoW + PoS)
UNIT-II	**CRYPTOGRAPHY** cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography
UNIT-III	**BITCOIN** Bitcoin Introduction, Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.
UNIT-IV	**ETHEREUM** Ethereum Virtual Machine (EVM) , Wallets for Ethereum, Solidity, Smart Contracts - some attacks on smart contracts, Hyperledger Fabric, Scaling the blockchain.
UNIT-V	**TRENDS AND TOPICS** Zero Knowledge proofs and protocols in Blockchain, Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash, Block chain Usecases: Finance and Industry.

TEXT BOOKS
• Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
• Foundation of Consensus, http://elaineshi.com/docs/blockchain-book.pdf

REFERENCE BOOKS
• https://eprint.iacr.org/2014/349.pdf
• https://eprint.iacr.org/2012/718.pdf
• https://github.com/ElementsProject/lightning/blob/master/doc/deployable-lightning.pdf
• https://www.hyperledger.org/use/tutorials
• https://docs.soliditylang.org/en/latest
• https://github.com/ethereum/wiki/wiki/White-Paper
• http://gavwood.com/paper.pdf
• https://eprint.iacr.org/2018/601.pdf
• https://eprint.iacr.org/2018/712.pdf

DATA SCIENCE	
Course Code: 24CSPE3041	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE OBJECTIVE (CO)
1. To perform exploratory analysis of multivariate data and scientific data visualisation
2. To conduct statistical hypothesis testing
3. To use regression techniques for predictive data analytics and time series modeling
4. To build capability of real life problem solving and dealing with large data.

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 role of EDA and probability in Data Science.
2. Apply and analyze the role of statistical/hypothesis testing for Data Analysis.
3. Understand and apply Regression for Predictive Data Analysis.
4. Analyze and evaluate time series data.
5. Build and create the applications using the concepts of Data Science.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√	√	
CO4					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION** Definition and scope of Data Science, History and evolution of Data ScienceApplications of Data Science in various domains, Overview of the Data Science process, Tools and technologies used in Data Science, Ethical considerations in Data Science.
UNIT-II	**DATA COLLECTION AND MANAGEMENT** Data types and data sources, Data collection methods, Data quality issues Data cleaning techniques, Handling missing data, outliers, and duplicate data, Handling multiple data sources Introduction to hypothesis testing, Using Python libraries for EDA (Pandas, Matplotlib, Seaborn)
UNIT-III	**DATA ANALYSIS** Introduction to Data analysis, Terminology and concepts, Descriptive statistics Summary statistics ,Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.
UNIT-IV	**DATA VISUALIZATION** Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Data visualization techniques Retinal variables, Mapping variables to encodings, Visual encodings.
UNIT-V	**APPLICATIONS** Demand forecasting, Traffic Accident Analysis and Prediction, Image Classification for Medical Diagnosis, Health Prediction System etc.

TEXT BOOKS

- Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython (2 ed.), O'Reilly, 2017. ISBN 978-1491957660.
- Klosterman, Stephen, Data Science Projects with Python: A Case Study Approach to Successful Data Science Projects Using Python (1 ed.), Packt Publishing Limited, 2019. ISBN 978-1838551025.
- An Introduction to Statistical Learning with Application in R, First Edition, by Gareth James et al. (2013)

REFERENCE BOOKS

- Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 2011.
- Tan, Pang-Ning. Introduction to data mining. Pearson Education India, 2007.
- Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol. 1. No. 10. New York, NY, USA:: Springer series in statistics, 2001.
- Shalev-Shwartz, Shai, and Shai Ben-David. Understanding machine learning: From theory to algorithms. Cambridge university press, 2014.
- R for Data Science, by Garrett Grolemund and Hadley Wickham (2016)
- Exploratory Data Analysis with R, by Roger D. Peng (2016)
- Introduction to linear algebra, by Gilbert Strang

SOFT COMPUTING	
Course Code: 23CSPE3031	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 about fuzzy set theory and FRBS.
4. To understand the concepts of GA.
5. To provide an insight on how the two methods can be integrates 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 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
CO1	√					
CO2		√				
CO3			√			
CO4				√		
CO5					√	
CO6						√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION** **SOFT COMPUTING:** Definition, hard and soft computing, major areas of Soft computing, Requirements and Applications of Soft computing. **Introduction to ANN:** What is Neural Network, Learning rules and activation functions, Single layer Perceptrons, Back Propagation Algorithm, Adaptive Resonance theory and Self Organizing Map.
UNIT-II	**FUZZY SETS:** Fuzzy set theory, fuzzy set operations, fuzzy rule Base system (FRBS), Fuzzifiction, Defuzzification.
UNIT-III	**GENETIC ALGORITHMS :** Introduction, Working principle, Generation of population, GA Operators : Encoding, Fitness Function, Reproduction, Crossover, Mutation, probability of crossover and probability of mutation, convergence
UNIT-IV	**HYBRID SYSTEMS:** 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.
UNIT-V	**TOOLS & APPLICATIONS FOR SOFT COMPUTING :** Introduction to Tools For Soft Computing –Virtual Lab, Introduction to Fuzzy Logic and GA Tool Boxes of MATLAB.

TEXT BOOKS

- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
- Genetic Algorithms: Search and Optimization, E. Goldberg.
- Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI

REFERENCE BOOKS

- Jang, J-S. R., Sun,C-T, Mizutani, E.: “Neuro–Fuzzy and Soft Computing”, Prentice Hall of India. 2002
- Klir, G. J. and Yuan, B.: "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice Hall. 1995
- Rajasekaran, S. and Vijayalakshmi Pai, G.A.: “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications”, Prentice Hall of India. 2003
- Sinha, N.K. and Gupta, M. M. : “Soft Computing and Intelligent Systems - Theory and Applications”, Academic Press. 2000
- Tettamanzi, A., Tomassini, M.: “Soft Computing: Integrating Evolutionary, Neural, and Fuzzy Systems”, Springer.

DISTRIBUTED OPERATING SYSTEM	
Course Code: 23CSPE3020	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 system.
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 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
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENT
UNIT-I	**INTRODUCTION TO DISTRIBUTED SYSTEM** 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-II	**CONCURRENCY CONTROL** Clock synchronization, Mutual Exclusion, Election algorithm, the Bully algorithm, a Ring algorithm, Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Comparison - Flat andnested distributed transactions - Atomic commit protocols - Concurrency controlin distributed transactions
UNIT-III	**DEADLOCK** Deadlock in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection, Threads, System models, Processors Allocation, Schedulingin Distributed System, Real Time Distributed Systems.
UNIT-IV	**DISTRIBUTED FILE SYSTEM** Distributed file systems: Distributed file system Design, Distributed file systemImplementation, 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
UNIT-V	**SECURITY** 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

TEXT BOOKS
• Andrew S. Tanenbaum, Maartenvan Steen, Distibuted Systems, —Principles and Pardigms, Pearson Education, 2002.
• George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, 3rd Edition, Pearson Education, 2002.
REFERENCE BOOKS
• Tanenbaum and Steen, Distributed Systems PHI, 2002.
• Sape Mullender, Distributed Systems 2nd Edition.
• Albert Fleishman, Distributed Systems: Software Design and Implementation, Springer Verlag, 1994.

SOFTWARE PROJECT MANAGEMENT	
Course Code: 23**CSPE3024**	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 understood the basics of the project management techniques.
3. To learn the feasible solution and optimum solution for the resource management. Learnt the time estimation and critical path for project.
4. To learn the various quality models and risk management in the 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. Analyse 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				✓

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Introduction and Software Project Planning:** 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	**Project Organization and Scheduling Project Elements:** 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.
UNIT-III	**Project Monitoring and Control:** 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.
UNIT-IV	**Software Quality Assurance and Testing Objectives:** 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.
UNIT-V	**Project Management and Project Management Tools Software Configuration Management:** 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

- Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.

REFERENCE BOOKS

- M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
- Royce, Software Project Management, Pearson Education
- Kieron Conway, Software Project Management, Dreamtech Press
- S. A. Kelkar, Software Project Management, PHI Publication

GRID COMPUTING	
Course Code: 24CSPE3026	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 introduction and application to Grid Computing.
2. To gain knowledge of web services architecture, XML, and related technologies.
3. To learn about the Open Grid Services Architecture (OGSA) and its platform components.
4. To understand the Open Grid Services Infrastructure (OGSI) and grid service management.
5. To comprehend security issues, including trust models, authentication, authorization, and identity management in grid environments.

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 genesis & know the applications of grid computing.
2. Understand the technology and tool kits for facilitating grid computing.
3. Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.
4. Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.
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.

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√				
CO2		√	√		
CO3				√	
CO4				√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION AND OVERVIEW OF GRID COMPUTING** Early Grid Activities, Current Grid Activities, An Overview of Grid BusinessAreas, Grid Applications, Grid Infrastructure
UNIT-II	**WEB SERVICES AND RELATED TECHNOLOGIES** 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
UNIT-III	**OGSA** Introduction to Open Grid Services Architecture (OGSA), Commercial Data Center- National Fusion Collaboratory, OGSA Platform Components
UNIT-IV	**OGSI** Introduction-Grid Services, A High-Level Introduction to OGSI, Introduction to Service Data Concepts, Grid Service: Naming and Change Management Recommendations.
UNIT-V	**SECURITY** Trust models for Grid security environment, Authentication and Authorization methods, Grid security infrastructure, and Identity and access management architecture.

TEXT BOOKS

- Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005.
- Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann.
- Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.

REFERENCE BOOKS

- Barry Wilkinson, "Grid Computing: Techniques and Applications", Chapman and Hall, CRC, Taylor and Francis Group, 2010.
- Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.

OBJECT ORIENTED ANALYSIS & DESIGN	
Course Code: 23CSPE3028	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 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.

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 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)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** -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-II	**STRUCTURAL & BEHAVIOURAL MODELLING** Structural Modeling Techniques Basic Building Blocks -- objects and classes, Structural Composition Techniques, Design Scaling Issues,**Behavioural Modelling :** 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.
UNIT-III	**ARCHITECTURAL MODELLING-**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
UNIT-IV	**Design Standards Architectural Patterns**: Design Patterns, Program Patterns, Behavioral Design Units Component-Based Specification Techniques **DPIM - Level One** : Requirements Analysis Techniques, Ad Hoc Approach to Design **DPIM - Levels Two, Three and Four**: 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
UNIT-V	**DPIM - Levels Five and Six** : Design Process Management and Optimization Design Metric Models Testing Maturity Model Extended V-Model Testing Techniques **OO Testing:** Introduction, Object Oriented testing process, testing of analysis and design model, testing of classes.

TEXT BOOKS

- S. R Schach, Introduction to Object Oriented analysis and Design, Mc Graw Hill, 2003
- Ali Bahrami , "Object Oriented System Development", McGraw Hill International Edition, 1999.
- Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services

REFERENCE BOOKS

- Booch G., "Object Oriented Analysis and Design", Addison Wesley Publishing Company, 2nd Edition, 2000.
- Rambaugh.J, Blaha. M. Premerlani.W, Eddy F and Loresen W, "Object Oriented Modeling andDesign",Prentice Hall of India, 1997.
- Bennett, S., "Schuam's Outline of UML". New York: McGraw-Hill 2004
- S. Perdita. "Using UML: Software Engineering with Objects and Components." Addison-Wesley 2000

NEURAL NETWORKS & FUZZY LOGIC	
Course Code: 23**CSPE3030**	Continuous Evaluation: 40 Marks
Pre-Requisite : Soft Computing Course	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
1. To provide in depth detail for perceptron.
2. To get familiar with the principles of RBF, RNN, unsupervised learning.
3. To learn fuzzy set theory, fuzzy logic and understand the role of uncertainty in real-time 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 mathematics behind the design of perceptron.
2. Correlate the need of extension of MLP to CNN.
3. Design and analyse the importance of kernel functions, RNN and memories.
4. Differentiate between fuzzy sets and crisp sets.
5. Apply and analyse the applications of fuzzy to reasoning and clustering

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

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√	√			
CO2			√		
CO3				√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (ANN) & SINGLE LAYER PERCEPTRON (SLP)** 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.
UNIT-II	**MULTI- LAYER FEED FORWARD NETWORKS** 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,
UNIT-III	**RECURRENT NETWORKS & ASSOCIATIVE MEMORIES** 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.
UNIT-IV	**FUZZY SETS, RELATIONS & LOGIC** Classical & Fuzzy Set Theory, Fuzzy Relation, Fuzzy Inference System, Fuzzy Logic and approximate reasoning. Fuzzy control System Design Problem, Industrial Applications.
UNIT-V	**FUZZY ARITHMETIC & OPTIMIZATION** 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.

TEXT BOOKS
• J.M. Zurada, "Introduction to artificial neural systems", Jaico Pub.
• Simon Haykin, "Neural Networks", PHI
• S. N. Sivanandam and S.N. Deepa, "*Principles of Soft Computing,*" 2nd Ed., Wiley India.

REFERENCE BOOKS
• Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004
• Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003
• S. Rajasekharan and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
• Timothy J. Ross, " Fuzzy Logic With Engineering Applications", Tata McGraw-Hill Inc. 2000

CYBER SECURITY	
Course Code: 23CSPE3032	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
1. To aware the students about the cyber security and its implications. 2. To provide students with a practical and theoretical knowledge of cryptography and network security. 3. To provide the students' knowledge of different types of attacks on the Network. 4. To aware the student about data privacy.

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. Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
2. Underline the need of digital forensic and role of digital evidences.
3. Explain the methodology of incident response and various security issues in 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)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√	√			
CO2		√	√		
CO3			√	√	
CO4				√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION C**yber-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.
UNIT-II	**INTRUSION DETECTION SYSTEMS-** 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.
UNIT-III	**SECURITY IN CLOUD COMPUTING-**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.
UNIT-IV	**DATA PRIVACY -** Fundamental Concepts, Definitions, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy in different domains- medical, financial, etc.
UNIT-V	**CRYPTOGRAPHY -**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. Roberto Di Pietro, Luigi V. Mancini, "Intrusion Detection System", Springer ,2008
5. William Stallings-"Cryptography and Network Security", Pearson education, 6th edition, SBN 10**:** 0133354695, 2013

REFRENCE 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.

DESIGN THINKING	
Course Code: 23CSPE3034	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 for 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 analyzing design thinking history and its various concepts.
4. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
5. Build the process model that is used to implement process application and use different mural template to apply design thinking concepts for solving real world problem.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**INTRODUCTION TO BUSINESS PROCESS MANAGEMENT &AS-IS BUSINESS PROCESS** 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.
UNIT-II	**PLAYBACK 0: MODELING PROCESS** 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.
UNIT-III	**ENTERPRISE DESIGN THINKING – HISTORY, OVERVIEW-** 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.
UNIT-IV	**ENTERPRISE DESIGN THINKING –7 KEY HABITS, THE LOOP, USER RESEARCH -** 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.
UNIT-V	**ENTERPRISE DESIGN THINKING – MAKE, USER FEEDBACK:-** 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.
UNIT-VI	**PROJECT-** 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

PREDICTIVE ANALYTICS	
Course Code: 23CSPE3036	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 the 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 for 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 Preditive 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 model 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				√	√

COURSE CONTENTS

UNIT-I	**ANALYTICS OVERVIEW** 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.
UNIT-II	**IBM SPSS MODELER & DATA MINING** What is a 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.
UNIT-III	**UNIT OF ANALYSIS** Concepts of Unit of analysis (Distinct, Aggregate, SetToFlag), Integrate data, CLEM Expression, Role of Relationship between two fields, Identifying the modeling objective.
UNIT-IV	**ADVANCED DATA PREPARATION WITH IBM SPSS MODELER** Functions to enrich data, Method to transform data, Cross-record functions, Sampling, Partitioning and sampling data, Improving Efficiency.
UNIT-V	**PREDICTIVE ANALYTICS WITH IBM WATSON STUDIO** 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.
UNIT-VI	**PROJECT** Predicting using IBM SPSS Modeler & IBM Watson with real Case studies.

TEXT/REFERENCE BOOKS
• IBM Courseware

Further suggested Readings
• IBM Courseware
• Predictive Analytics Mesmerizing & fascinating by ERIC SIEGEL

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	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 overview of an exciting field of business intelligence.
2. To introduce IBM Cognos Analytics and its position within an analytics solution.
3. To teach the fundamental techniques and principles in achieving big business intelligence with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in for 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 the vision of Business Intelligence from a global context.
2. Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.
3. Apply and analyse various prompt types and conditionally render objects in reports .
4. Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.
5. Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

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

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**BUSINESS INTELLIGENCE** Definition with Real Time Examples, How business intelligence can turn data into insight, Use of Business Intelligence- how it can help to combat fraud and understand social sentiments., Future of business intelligence and analytics.
UNIT-II	**IBM COGNOS ANALYTICS FOR COUNSUMERS** Why IBM Cognos Analytics? What is IBM Cognos? List v/s Crosstab, Examine detail filters and summary filters, Introduction to visualization, Traditional visualization v/s RAVE visualization.
UNIT-III	**IBM COGNOS ANALYTICS:AUTHOR REPORT FUNDAMENTALS** Concepts and types of prompts, expressions using functions, reuse object, drill -through reports, analyse multi-lingual reports, Highlight exceptional data
UNIT-IV	**IBM COGNOS ANALYTICS:AUTHOR REPORT ADVANCED** Theory, query models, SQL statements, distribute reports using bursting, Analyze reports by joining queries, dynamic headers and titles that reflect report data, tooltips that clarify report data, send emails using links in a report.
UNIT-V	**IBM COGNOS ANALYTICS:AUTHOR ACTIVE REPORTS** Active Reports, debug active report, Examine Active Report controls, Active Report variables, Create a simple Active Report using Static and Data-driven controls, decks and data decks to display traditional charts creation and analysis of Dashboard.
UNIT-VI	**PROJECT** Analysis for real case studies using dashboard, stories and exploration with IBM Cognos.

TEXT/REFERENCE BOOKS
• IBM Courseware

Further suggested Readings
• IBM Courseware

INTERNET OF THINGS	
Course Code: 23CSPE3040	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 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

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 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 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)

	CLO1	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
CO1	√	√				
CO2			√	√		
CO3					√	√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**Introduction to IoT:** Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensing: Sensors and Transducers, Sensor Classes, Sensor Types, Actuation: Actuator Basics, Actuator Types **Basics of IoT Networking:** IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP,AMQP (Advanced Message Queuing Protocol).
UNIT-II	**IoT Protocols:** Protocol Standardization for IoT-M2M and WSN Protocols. **Connectivity Technologies:** IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave, ISA100.11a
UNIT-III	**Sensor Networks:** 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-IV	**Introduction to Arduino**: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Integration of Sensors and Actuators with Arduino, **Introduction to Raspberry Pi**, Implementation of IoT with Raspberry, Software Defined Networking, Software Defined IoT Networking
UNIT-V	**Cloud Computing:** Fundamentals, Service Models, Service Management and Security, Case Studies, Open Source Platform, Sensor Cloud, Fog Computing, **Application Domains of IoT :** 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	**PROJECT-**Research Activities on IoT with projects and research letters.

TEXT BOOKS
• Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" –– CRC Press-2012
• Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.
• Dieter Uckelmann, Mark Harrison, "Architecting the Internet of Things", Springer-2011.
• Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
• The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

REFERENCE BOOKS
• Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
• Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

NETWORK SECURITY & CRYPTOGRAPHY	
Course Code: 23**CSPE4019**	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**
CO1	√	√			
CO2		√	√		
CO3			√		
CO4				√	√
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**FUNDAMENTALS- Security trends** - 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	**SYMMETRIC KEY CRYPTOGRAPHY-** MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid‟s algorithm-Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY

UNIT NUMBER	COURSE CONTENTS
	CIPHERS: SDES – 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	**PUBLIC KEY CRYPTOGRAPHY** **MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY**: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic- Elliptic curve cryptography.
UNIT-IV	**MESSAGE AUTHENTICATION AND INTEGRITY** 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	**SECURITY PRACTICE AND SYSTEM SECURITY** Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TEXT BOOKS

- Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, Starch Press, 2008.
- William Stallings, "Cryptography and Network Security: Principles and Practices", Sixth Edition, Pearson Education, 2014.

REFERENCE BOOKS

- "The Shellcoder's Handbook: Discovering and Exploiting Security Holes", 2nd Edition by Chris Anley et al.
- N. Ferguson, B. Schneier, and T. Kohno. "Cryptography Engineering: Design Principles and Practical Applications". Wiley, 2010.
- Neil Daswani, Christoph Kern, and Anita Kesavan, "Foundations of Security: What Every Programmer Needs to Know", Frist Edition, Apress, 2007.
- SNMP: A Guide to Network Management (MGH).
- Telecom Network Management by H.H. Wang (MGH).
- Network Management by U. Dlack (MGH).

SOFTWARE TESTING	
Course Code: 23CSPE4033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES

1. To understand the basics of Software testing
2. To recognize the various types of software testing techniques
3. To analyse the various levels of software testing
4. To explore software automation process
5. To understand Basic software debugging methods.

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 the fundamentals of software testing using real world examples
2. Identify and apply relevant testing techniques suitable for a real world scenario
3. Investigate the different levels in testing
4. Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.
5. Use practical knowledge to test software and understand the trade-offs between testing techniques
6. Implement Test Automation process and experiment with testing tools.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION** What is software testing and why it is so hard? Basic Definitions: Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing.
UNIT-II	**TESTING TECHNIQUES** White –Box &Black –Box Testing, Boundary Value Analysis, Equivalence Class Testing, Decision table based Testing, Cause-Effect Graph Technique, Cyclomatic Complexity Analysis.
UNIT-III	**REDUCING THE NUMBER OF TEST CASES** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing, Regression Testing **Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, Debugging, Domain Testing.
UNIT-IV	**SYSTEM TESTING** Verification and Validation Testing, Alpha Testing, Beta Testing, Stress Testing, Load Testing, Volume Testing, Usability testing, Bug, Bug life cycle.
UNIT-V	**TESTING TOOLS** Test Automation: Scope of Automation, Process Model for Automation, Challenges in Automation, Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools.

TEXT BOOKS

- Software Testing: Principles and Practices, Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education, 2008.
- Software Testing: Principle, Techniques and Tools, M. G. Limaye, Tata McGraw Hill, 2009.
- Effective Methods for Software Testing, William E. Perry, John Wiley and Sons,

REFERENCE BOOKS

- An Integrated Approach to Software Engineering, Pankej Jalote, Narosa Publishing House, New Delhi 1997.
- The Art of Software Testing, Glenford J.Myers, John Wiley & Sons, 1979.
- Software Testing: A Craftman's Approach, P. C. Jorgensen, CRC Press, 1995.
- Software Testing Techniques, Boris Beizer, Dreamtech, 2006.
- Effective Software Testing: 50 Specific Ways to Improve Your Testing, Dustin, Pearson Education, 2002.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 23CSPE4023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
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.

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 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 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 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)

	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√	√		
CO3				√	
CO4				√	√
CO5					√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**AD HOC Wireless-** 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 (DBR), Adhoc Distance Vector (AoDV) routing, Routing Protocols, Application of Ad Hoc and sensor networks
UNIT-II	**Transport Layer & Security Protocols-**Issues in designing transport layer protocols, classification of transport layer solutions, TCP over Ad Hoc Wireless Networks, Network Security requirements and Attacks
UNIT-III	**Wireless Sensor Networks** 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	**Communication Protocols-** 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	**Transport & QoS in WSN -**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	**PROJECT-** Research Activities and hands-on experience in designing a mobile ad hoc network using the NS2 network simulator

TEXT BOOKS

- C. S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India , 2007.
- Andreas Willig and John H. Karl, Protocols & Architectures for Wireless Sensor Networks, Wiley, 2005

REFERENCE BOOKS

- B. Tavli and W. Heinzelman, Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications, Springer , 1st Edition, 2006
- Ramin Hekmat, Ad-hoc Networks: Fundamental Properties and Network Topologies, Springer , 1st Edition, 2006

ADVANCED JAVA PROGRAMMING	
Course Code: 23**CSPE4035**	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					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO ADVANCED JAVA** Java Streaming – Components and events handling – Threading concepts – Networking features – Byte code interpretation – Media Techniques.
UNIT-II	**SWINGS** Introduction to swings, difference between AWT and Swings, java foundation classes, java swings classes.
UNIT-III	**ADVANCED NETWORKING** Client- Sever computing – Sockets – Content and Protocols handlers – Developing distributed applications – RMI – Remote objects – Object serialization
UNIT-IV	**REMOTE METHOD INVOCATION** Remote Method Invocation (RMI): RMI Architecture, Designing RMI application, Executing RMI application.
UNIT-V	**RELATED JAVA TECHNIQUES** 3D graphics – JAR file format and creation – Internationalization. **SERVLETS** 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 Blooberg. Jeff Kawski, and Paul Treffers, "*Web Page Scripting Techniques",*Hayden books, 1996.

NASSCOM ASSOCIATE ANALYTICS - II	
Course Code: 23**CSPE4037**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
• To provide knowledge of the 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 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.

UNIT NUMBER	**COURSE CONTENTS**
UNIT-I	**Data Management & Introduction to Big Data Tools (NOS 2101)** 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	**Big Data Analytics & Machine Learning Algorithms (NOS 2101)** 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 observer 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	**Data Visualization (NOS 2101)** Prepare the data for Visualization, Use tools like Tableau, QlickView and D3, Draw insights out of Visualization tool.
UNIT-IV	**Maintain Healthy, Safe & Secure Working Environment (NOS 9003)**Introduction, workplace safety, Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, assessment
UNIT-V	**Provide Data/Information in Standard Formats (NOS 9004)** Introduction, Knowledge Management, Standardized reporting & compliances, Decision Models, course conclusion. Assessment

TEXT/REFERENCE BOOKS
• NASSCOMM

DATA WAREHOUSING & DATA MINING	
Course Code: 23CSPE4025	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE

1. To teach the basic principles, concepts and applications of data warehousing and data mining.
2. To familiarize Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
3. To introduce the task of data mining as an important phase of knowledge recovery process.
4. To impart knowledge of the fundamental concepts that provide the foundation of data mining.
5. To perform classification and prediction of data.

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 functionality of the various data mining and data warehousing component.
2. Design data warehouse with dimensional modelling and apply OLAP operations.
3. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.
4. Describe complex data types with respect to spatial and web mining.
5. Extract knowledge using data mining techniques.
6. Apply the Data Mining principles and techniques for real time applications.

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

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

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**DATA WAREHOUSING AND BUSINESS ANALYSIS:** Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.
UNIT-II	**DATA MINING:** 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	**CLASSIFICATION AND PREDICTION:**Issues Regarding 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	**CLUSTER ANALYSIS:** 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	**MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

TEXT BOOKS

- Data Warehousing In the Real World; Sam Anahory & Dennis Murray; 1997, Pearson.
- Data Mining- Concepts & Techniques; Jiawei Han & Micheline Kamber- 2001, Morgan Kaufmann.
- Data Mining Techniques; Arun Pujari; 2001, University Press; Hyderbad.

REFERENCE BOOKS

- Data Mining; Pieter Adriaans & Dolf Zantinge; 1997, Pearson,
- Data Warehousing, Data Miniing and OLTP; Alex Berson, 1997, Mc Graw Hill.
- Data warehousing System; Mallach; 2000, Mc Graw Hill.
- Building the Data Warehouse; W.H. Inman, 1996, John Wiley & Sons.
- Developing the Data Warehouses; W.H Ionhman,C.Klelly, John Wiley & Sons.
- Managing the Data Warehouses; W.H.Inman, C.L.Gassey, John Wiley & Sons.

MOBILE COMPUTING	
Course Code: 23**CSPE4027**	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**
CO1	√		
CO2		√	
CO3			√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Overview of Ad Hoc Networks:** 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	**Wireless and Mobile Computing Models-**LAN Protocols: IEEE 802.11/a /g/n & Bluetooth, Data Management Issues. Sensor Networks- Challenges, Architecture, and Applications.
UNIT-III	**Routing in Mobile Networks-** 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.
UNIT-IV	**Mobile TCP/IP -D**istributed 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.
UNIT-V	**MOBILE AGENTS** 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

- Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
- Wireless Communications & Networks, Second Edition,William Stallings by Pearson
- TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

MACHINE LEARNING USING R	
Course Code:23CSPE4029	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
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.

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. 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)

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO7
CO1	√						
CO2		√	√				
CO3				√	√	√	
CO4							√
CO5							√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**INTRODUCTION TO R AND PROBABILTY :** *R basics* – 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	**INTRODUCTION TO MACHINE LEARNING :** Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques, Machine Learning Models, Data- pre-processing and feature Engineering
UNIT-III	**SUPERVISED LEARNING:** *Machine learning Algorithms for classification problem*: Decision Trees, K-NN, SVM, Naïve Bayes Classifier, Bayesian learning, Bayesian network. *Regression* : Linear , Logistic, Ridge, Regularization, Bias/ Variance Tradeoff,
UNIT-IV	**ENSEMBLE AND UNSUPERVISED LEARNING:** Bagging, Boosting, Random forest, *Clustering***:** K-means, Heirarchical clustering, Partitional clustering, Apriori algorithm, FP growth, Validation Techniques in clustering.
UNIT-V	**REINFORCEMENT AND TRANSFER LEARNING:** 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. **CASE STUDY:** Object Detection, Recommender System, Malware Classification, Crop Yield Prediction, machine Learning in Networks.

TEXT BOOKS
• R for data science : Import, Tidy, Transform, Visualize, And Model Data, Hadley Wickham, O'Reilly
• Introduction to Machine Learning, E. Alpaydin. MIT Press
• Machine Learning, T.M. Mitchell, Mc-Graw Hill

REFERENCE BOOKS
• 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 SOURCE SOFTWARE	
Course Code: 23**CSPE4031**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
1. To introduces concepts, principles and applications of open source software. 2. To discuss about open source software development process. 3. To understand the difference between open source software and commercial software. 4. To familiarize with Linux operating system. 5. To understand and development of 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 system.
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					√	√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**UNIT I OPEN SOURCE**: Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions.
UNIT-II	**UNIT II LINUX**: 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	**UNIT III APACHE**: 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	**UNIT IV MYSQL**: 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	**UNIT V PHP**: 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

NASSCOM ASSOCIATE ANALYTICS - III	
Course Code: 23**CSPE4039**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
• 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 is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

UNIT NUMBER	CONTENTS
UNIT-I	**Introduction to Predictive Analytics & Linear Regression (NOS 2101)** 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.
UNIT-II	**Logistic Regression Objective Segmentation (NOS 2101)-** 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.
UNIT-III	**Time Series Methods/Forecasting, Feature Extraction (NOS 2101)** Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average, Energy etc and Analyze for prediction.
UNIT-IV	**Working with Documents (NOS 0703)** 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, Intectual Property and Copyright, Document preparation tools – Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.
UNIT-V	**Develop Knowledge, Skill and Competences (NOS 9005)** Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.

TEXT/REFERENCE BOOKS
• NASSCOMM

ADVANCED INTERNET OF THINGS	
Course Code: 24CSPE4041	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
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**Advanced IoT Concepts and Architectures** 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	**IoT Sensor Networks and Data Analytics** 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	**IoT Security and Privacy** 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	**IoT Applications and Case Studies** 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	**Emerging Trends and Future Directions in IoT** 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 Minteer 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.

ADVANCED BLOCKCHAIN	
Course Code: 23CSPE4047	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
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	CONTENTS
UNIT-I	**Blockchain prerequisites and Introduction to Blockchain** 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 Deplooying Docker containers, Introduction to Blockchain
UNIT-II	**Blockchain in detail and Blockchain Status** 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
UNIT-III	**Linux Foundation Hyperledger and Blockchain Use-Cases** 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
UNIT-IV	**Blockchain Developer part 1:-** 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
UNIT-V	**Blockchain Developer part 2:-** Consensus, ordering service and transaction endorsement, Chaincode structure, lifecycle and deployment approaches., Blockchain deployment with Docker and Kubernetes, Blockchain security on Hyperledger Fabric
UNIT-VI	**PROJECT** Research Activities on Blockchain network

REFERENCES
IBM Skill Set

SYLLABUS OF ABILITY ENHANCEMENT COURSES
COMMUNICATIVE ENGLISH
(COMMON TO ALL BRANCHES OF B.TECH.)

Communicative English (Common To All branches of B.Tech)	
Credits: 2	**Continuous Evaluation**:40 Marks
L T P: 2 0 0	**End Semester Examination**:60 Marks
Prerequisite: Nil	**Course Code:23AEC101**

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

Communicative English Lab (Common To All branches of B.Tech)	
Credits: 1	**Continuous Evaluation**:60 Marks
L T P: 0 0 2	**End Semester Examination**:40 Marks
Prerequisite: Nil	**Course Code:23AEC151**

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. 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 (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					✓

LIST OF Activities

Unit-I

- Listening and Speaking
- Accent in speech
- Longer Discourse (dialogues, songs, contextual speech etc.)
- Role-play
- Practicing sounds of English
- Extempore
- Presentations

Unit-II

- Reading comprehension practice: Technical text
- General text

Unit-III

- Guided composition
- Free-writing

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

HINDI -I	
Course Code: 24HIN-101- I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

Course Description:

विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिन्दी विषय का पाठ्यक्रम तैयार किया है। हिन्दी विषय के प्रश्न पत्र की सामग्री में ज्ञान तथा शिक्षा के बदलते परिदृश्य को ध्यान में रखा गया है। हिन्दी के भक्तिकाल, रीतिकाल और आधुनिक काल 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, भाषायी क्षमता एवम् अभिवृद्धि भी इस पाठ्यक्रम का लक्ष्य है।

(Course Content)

(Unit-A)

इस इकाई में हिंदी भक्तिकाल के प्रमुख कवि कबीरदास हैं।

कबीरदास- कबीरदास के दोहे (5 दोहे)

(Unit-B)

इस इकाई में हिंदी रीतिकाल के प्रमुख कवि बिहारीलाल हैं।

बिहारीलाल – दोहे (5 **दोहे)**

(Unit-C)

इस इकाई में हिंदी आधुनिक काल के प्रमुख कवि माखनलाल चतुर्वेदी हैं।

माखनलाल चतुर्वेदी- पुष्प की अभिलाषा (कविता)

(Unit-D)

यह इकाई संचार कौशल से सम्बन्धित है. इसमें

(i) हिंदी के प्रमुख मुहावरे और लोकोक्तियाँ

(ii) आत्म परिचय (self-introduction), साक्षात्कार कौशल (interview skills), कार्यक्रम संचालन/मंच प्रबंधन (event management)

Course Outcomes:-

पाठ्यक्रम परिणाम

(1.Knowledge Outcome)

1. ज्ञान का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिन्दी क़े प्रमुख कवि जो पाठ्यक्रम में शामिल है, उनकी कविताओं की व्याख्या और काव्यगत विशेषताओं को छात्र समझेंगे ।

- छात्रों को काव्य में रस, अलंकार और छन्द का ज्ञान प्राप्त होगा|

-व्याकरण के अध्ययन से छात्रों को भाषा बोलने, लिखने और प पढने में सहायता प्राप्त होगी।

(2.Skill Outcome)

कौशल का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिंदी कवियों व उनकी कविताओं से परिचित हो जाएंगे।

- छात्र दोहे और कविता समझने में सक्षम होंगे।

-व्याकरण के ज्ञान के साथ -साथ शब्दों के उच्चारण के बोध से अवगत होंगे।

(Methodology)

(पद्धति)

- कक्षा व्याख्यान

-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 |

(Required Books and Materials)

आवश्यक पुस्तकें और सामग्री

-कबीर ग्रन्थावली, संपादक-श्यामसुन्दर दास, काशी नागरी प्रचारिणी सभा |

- बिहारी सतसई, साहित्य संस्थान प्रयाग|

-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद |

-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन दिल्ली |

HINDI-II	
Course Code:24HIN201-II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

LAGHU KATHAEN AUR SANCHAR KAUSHAL

Course Description:

विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिंदी विषय का पाठ्यक्रम तैयार किया है | हिंदी विषय के प्रश्न पत्र 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 कल्पना शक्ति के विकास के साथ-साथ मनोरंजन भी होता है| संचार कौशल में मुहावरे, लोकोक्तियां, पत्र लेखन 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 सिध्द करती है |

Course Content

(Unit-A)

इस इकाई में हिंदी लघु कथाओं का संक्षिप्त परिचय दिया गया है –

1 हिंदी लघु कथा का सामान्य परिचय |

2 हिंदी लघु कथा के प्रमुख प्रकार |

(Unit-B)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 अंगूर की बेल

2. किसान और ठग

(Unit-C)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 बुराई का फल

2 चार विद्वान ब्राह्मण

(Unit-D)

यह इकाई संचार कौशल से सम्बंधित है, इसमें

(i) प्रेस रिपोर्ट, विज्ञापन, अनुवाद

(ii) **हिंदी पत्र लेखन और अपठित गद्यांश को समझना व तर्कसंगत उत्तर देना अपेक्षित है|**

(Course Outcome)

पाठ्यक्रम परिणाम

(1.Knowledge Outcome)

1 ज्ञान का परिणाम

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

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

हिंदी लघु कथाओं के मूल उद्देश्य को समझने में विद्यार्थी निपुण हो जाएंगे| लघु कथाओं 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)

2 कौशल का परिणाम

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

-पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिंदी लघु कथाओं से मनोरंजन भी होगा |

-विद्यार्थी लघु कथाओं के मूल कथ्य को समझेंगे|

-विचार तत्व के बोध से अवगत होंगे|

-हिंदी में पत्र लेखन और अपठित गद्यांश को समझने में सक्षम होंगे |

(**Methodology)**

(पध्दति)

- कक्षा व्याख्यान

-व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा|

-समय-समय पर छात्रों को प्रदत्त कार्य दिया जाएगा|

-दैनिक प्रश्नावली|

(Required Books and Materials)

आवश्यक पुस्तकें और सामग्री

-पाठ्यक्रम में निर्धारित लघु कथाओं का संकलन |

-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद |

-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन

GERMAN LANGUAGE PHASE I	
Course Code: 21FLGR301/23AEC104	Continuous Evaluation: 40.Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

1. To develop oral and written skills of understanding, expressing and exchanging Information/ interacting.
2. To develops the ability to construct sentences and frame questions.
3. To provide German language as a competitive edge in career choices.
4. To know the culture of the countries where the German language is spoken.
5. To provide employment opportunities as well as helping them to develop projects on browsing German websites

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. Read and write short, simple texts.
2. Have Fluency in reading and writing.
3. Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. Know the culture of the countries where the German language is spoken.
5. Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

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

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : INTRODUCTION

Grüße, Wortschatz

UNIT-II : THEMEN

Das Alphabet, die Aussprache, die Zahlen, Land und Stadt beschreibung, Berufe, rede über Dinge, die Zeit, Mahlzeiten und Getränke

UNIT-III : GRAMMATIK

Plural, Artikel, Possessive Artikel, Adjektive, Sich vorstellen, Verben (regulär, unregelmäßig, Pronomen), Nominativ Pronomen, Präpositionen,

UNIT-IV : WORTSCHATZ

emanden vorstellen, Nationalitäten, Länder, Zahlen, Über die Wochentage sprechen, Die Monate des Jahres, Die Berufe, Die Farben, Die Gegensätze, Die Sätze mit der Zeit

UNIT-V : MÜNDLICHER AUSDRUCK

Mündliche und Höraktivitäten

TEXT BOOK

1. Tangram aktuell 1 (Lektion 1-4 Kursbuch + Arbeitsbuch, Lektion 5-8 Kursbuch + Arbeitsbuch, Übungsheft)

REFERENCE BOOKS

2. Wolfgang Hieber: Lernziel Deutsch, Teil 1. Max Hueber Verlag

3. Korbinian Braun, u.a.: Deutsch als Fremdsprache IA, Grundkurs. Ernst Klett Stuttgart

4. Rolf Brüseke: Starten Wir! A1. München: Hueber Verlag

GERMAN LANGUAGE PHASE II	
Course Code: 21FLGR401/23AEC204	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

6. To demonstrate their ability to recognize, identify, extract and/or differentiate key information conveyed in spoken announcements, instructions, and in interactions between native speakers on familiar topics.
7. To demonstrate effective speaking and listening skills in German on informal and some formal topics related to personal, professional, academic, and leisure activities.
8. To develop awareness of the nature of language and language learning.

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:

6. Read and write short, simple texts.
7. Have Fluency in reading and writing.
- Use language creatively and spontaneously.
8. Get awareness about cross-cultural and intercultural difference.

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

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓		
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : THEMEN
Einkaufen, Tagesablauf, Lebenslauf , Nach dem Weg fragen, Wegbeschreibungen, Der Körper, Ereignisse der Vergangenheit erzählen

UNIT-II : GRAMMATIK
Trennbare und untrennbare Verben, Dativ , Modalverben, Präteritum von sein, haben, Perfekt

UNIT-III : WORTSCHATZ
Kleidung, Haushaltswaren, Sachen zum Essen und Trinken, Verkehrsmittel, Namen von Orten und Sehenswürdigkeiten, Information über Deutschland, Ordinalzahlen

UNIT-IV : KOMPOSITION

Themen zum schreiben wie Deutschland und Delhi, was haben Sie am wochenende gemacht, Traummann/Traumfrau

UNIT-V: Mündlicher Ausdruck

Sprechen uber die Stadt, Das Haus, Meine Famile

TEXT BOOK

1. Tangram aktuell 1 (Lektion 1-4 Kursbuch + Arbeitsbuch, Lektion 5-8 Kursbuch + Arbeitsbuch, Übungsheft)

REFERENCE BOOKS

2. Wolfgang Hieber: Lernziel Deutsch, Teil 1. Max Hueber Verlag

3. Korbinian Braun, u.a.: Deutsch als Fremdsprache IA, Grundkurs. Ernst Klett Stuttgart

4. Rolf Brüseke: Starten Wir! A1. München: Hueber Verlag

Website pages:

1. https://www.nthuleen.com/teach.html

FRENCH LANGUAGE PHASE I	
Course Code: 21FLFR301/23AEC103	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

9. To develop oral and written skills of understanding, expressing and exchanging Information/ interacting.
10. To develops the ability to construct sentences and frame questions.
11. To provide French language as a competitive edge in career choices.
12. To know the culture of the countries where the French language is spoken.

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:

9. Read and write short, simple texts.
10. Have Fluency in reading and writing.
- Use language creatively and spontaneously.
11. Know the culture of the countries where the French language is spoken.

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

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : INTRODUCTION

Les Salutations, Vocabulaire

UNIT-II : SUJETS

L'Alphabet, Le Prounciation, Les Nombres, Décrire votre pays, ville, Les Professions, Parler de choses,L'Heure, Les Repas et les boissons

UNIT-III : GRAMMAIRE

Le Nom et le pluriel des noms, Les Articles, Les Adjectifs Possessifs, Les Adjectifs Qualificatifs, Se présenter, Les Verbes (Regular, irregular, pronominaux), Les Pronoms Sujet, Les Prépositions, L'interrogation

UNIT-IV : LEXIQUE

Présenter quelq'un, Les nationalités, Les Pays, Les Nombres, Parler des jours de la semaine, Les mois de l'année, Les Professions, Les Couleurs, Les Contraires, Les phrase avec l'heure

UNIT-V : L'EXPRESSION D'ORALE

Les activites d'orale et ecouter

TEXT BOOK

1. Version Originale – 1 Livre de l'élève: Monique Denyer, Agustin Garmendia, Marie-Laure Lions Olivieri, Editions Maisons des Langues, Paris

REFERENCE BOOKS

2. Nathan verbs conjugasion , Le Robert Nathan, Paperback
3. Larrouse French to English Dictionary, Larrouse, Paperback
4. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, Cle International, Paris.

FRENCH LANGUAGE PHASE II	
Course Code: 21FLFR401/23AEC203	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE OBJECTIVES (COs)

13. To Demonstrate an elementary knowledge of French sentence structure through speaking and writing.
14. To develop the language proficiency required to communicate effectively in French.
15. To form a sound base of the skills, language and attitudes required for progression to work or further study, either in French or another subject area.
16. To develop awareness of the nature of language and language learning.

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:

12. Read and write short, simple texts.
13. Have Fluency in reading and writing.

- Use language creatively and spontaneously.

14. Know the culture of the countries where the French language is spoken.

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

COURSE LEARNING OUTCOMES / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓		
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT-I : SUJETS

La France, Le Fromage, le vin, Les saisons, Les recettes, Indiquer un chemin,Demander la direction, Donner des indications, Le corps, Les elements du passé, Raconteur une journée

UNIT-II : GRAMMAIRE

La negation, L'imperatif ,Le passé recent,Le future, Le passé compose, L'imparfait, Les nombres ordinaux

UNIT-III : LEXIQUE

Les vêtements, Les animaux, Parler de prix, Le corps, Vocabulaire de la gare et du train, Le voyage, Les achats Les Prepositions, L'interrogation

UNIT-IV : Composition

les sujets pour l'ecriture comme la maison, l'ecole

UNIT-V : L'expression d'orale

Les etudiants ecrivent le petit paragraphess sur les sujets en utillisant les expression et le temps comme ma maison , ma famille.

TEXT BOOK

1. Version Originale – 1 Livre de l'élève: Monique Denyer, Agustin Garmendia, Marie-Laure Lions Olivieri, Editions Maisons des Langues, Paris

REFERENCE BOOKS

2. Nathan verbs conjugasion , Le Robert Nathan, Paperback
3. Larrouse French to English Dictionary, Larrouse, Paperback
4. Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, Cle International, Paris.
5. Alter Ego Part 1
6. Echo Part 1

SYLLABUS OF SKILL ENHANCMENT COURSES
SEMESTER – III

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 3**	**Course Category**	**SEC**
Course Code	**23SS351**	**Course Title**	**Effective Communication Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

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, engaging, assessing and re 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) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
TO1	√		
TO2	√	√	
TO3		√	√

Unit	**Course Contents**	**Student Engagement Activity**
Unit-I	**Verbal Communication Skills** • Communication Process & its importance • 7 C's of Communication • Formal & Informal Conversation • Requirements of effective verbal communication	Conversation Cards Activity
Unit-II	**Nonverbal Communication Skills** • Importance of nonverbal skills in effective communication • Types of nonverbal (body language) skills • Barriers to nonverbal communication	Power of Body Language Activity
Unit-III	**Listening Skills** • Role of listening skills in effective communication • Barriers to listening • Overcoming listening barriers • Empathetic listening & avoiding selective listening	Chinese Whisper Activity
Unit-IV	**Reading & Writing Skills** • Types of reading strategies to enhance improve reading skills • Types of written communication	The What IF Activity

Unit- V	**Visual Communication** • Types of visual communication • Importance of visual communication • Picture narration/description technique	Interpret The Picture Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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		

DIGITAL MARKETING	
Course Code: 24CS0201C	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination: 30 Marks
L T P : 0 0 2	
Credits: 2	

TRAINING OBJECTIVES(TOs)

1. To provide a foundational understanding of digital marketing concepts and strategies.
2. To explain the principles and practices of Search Engine Optimization (SEO).
3. To explore the role and strategies of social media marketing.
4. To examine digital advertising tools and methods for optimizing ad performance.
5. To design marketing strategy.

TRAINING LEARNING OUTCOMES (TLO's)

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

6. Explain the importance and components of digital marketing.
7. Understand how search engines work and apply SEO techniques to improve website visibility.
8. Develop strong social media profiles and create effective social media marketing strategies.
9. Utilize digital advertising tools and measure the performance of digital advertising campaigns.
10. Analyze and design marketing strategy for a given application or domain.

TRAINING LEARNING OUTCOMES (TLOs)-TRAINING OBJECTIVES (TOs) MAPPING

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	TRAINING CONTENTS	ACTIVITY
UNIT-I	**INTRODUCTION TO DIGITAL MARKETING & MARKETING ANALYSIS:** 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.
UNIT-II	**SEARCH ENGINE OPTIMIZATION(SEO):** Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, , Types Of SEO technique, Keywords, Keyword Planner tools	**Review the SEO history and current status of a real-world website**
UNIT-III	**SOCIAL MEDIA MARKETING:** Introduction to Social Media Networks, Types of Social Media Websites and their Marketing strategies. Creating Strong Social Media Profiles.	**Develop a social media strategy for a startup, focusing on creating strong profiles and engaging content.**
UNIT-IV	**ADVERTISING TOOLS and OPTIMIZATION:** 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
UNIT-V	**CASE STUDY/HANDS-ON:** 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.	

TEXT BOOKS

- Digital Marketing –Kamat and Kamat-Himalaya
- Marketing Strategies for Engaging the Digital Generation, D. Ryan

REFERENCE BOOKS

- Digital Marketing, V. Ahuja, Oxford University Press
- Digital Marketing, S.Gupta, McGraw-Hill
- Quick win Digital Marketing, H. Annmarie , A. Joanna, Paperback edition

SEMESTER –IV

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 4**	**Course Category**	**SEC**
Course Code	**23SS452**	**Course Title**	**Teamwork & Interpersonal Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
- TO2. To equip the students with capability of handling stress and utilization of work time effectively.
- TO3. 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:

- TLO1. To be confident working in a team and leading it as well.
- TLO2. 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.
- TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3	TLO4
TO1	√			
TO2		√		
TO3			√	√

Unit	Course Contents	Student Engagement Activity
Unit - I	**Team Management** • Team communication & team conflict resolution • Role of a team leader • Team goal setting & understanding team development • Team dynamics & multicultural team activity • Johari Window Model	Collaborative Working Game Activity

Unit-II	**Time Management** • Time management matrix • Pareto Principle (80/20 rule) • Development process of plan of action	What You Did Yesterday Activity
Unit-III	**Leadership** • Difference between leadership & management • Types of leadership style • Core leadership skills	Lead The Blindfolded Activity
Unit-IV	**Stress Management** • Sign of stress & its impact • Types of stress • Techniques of handling stress	Keeping Cool Activity
Unit – V	**Emotional Intelligence** • Emotional intelligence & emotional competence • Components & behavioral skills of emotional intelligence	Guess The Emotion Game Activity
Unit – VI	**Critical Thinking** • Types of thinking & Characteristics • Critical thinking standards • Barriers to critical thinking	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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: 23CS0202B	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 users 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					√

TRAINING CONTENTS

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
I	**INTRODUCTION TO DT** 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	Product that you loved and hated activity.
II	**DEFINE PHASE OF DT** 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.	Interview people and fill the DT Question template
III	**IDEATE PAHSE OF DT** 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 protypes, Recognize the importance of the prototype phase in DT.	Ideate a solution for a Given problem.
IV	**INTRODUCTION TO VR and AR** Historical Overview, Current Trends and Future applications of Immersive Technologies, Best practices in VR, AR and Mixed Reality (MR),Case Study : Google Lens, ARCore	To study various AR and VR based existing applications.
V	**HANDS ON ACTIVITY** 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 how AR and VR can be used in Education.	Designing of Solution to the Problem.

LEARNING RESOURCES

1. Hooked by Nir Eyal
2. The Art of Creative Thinking by Rod Judkins
3. Start Up nation by Dan Senor and Saul singer
4. Start with Why by Simon Sinek
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

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II	
Course Code: 23CS0202	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**
TO1	√			
TO2		√		
TO3		√	√	
CO4			√	√

TRAINING CONTENTS

MODULE	TRAINING CONTENTS	STUDENTS ENGAGEMENT ACTIVITY
I	**INTRODUCTION:** 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
II	**PROBLEM SOLVING:** Depth-first, breadth-first search, Problem Reduction, Constraint Satisfaction , Means-End Analysis.	Solving manually constraint satisfaction problem
III	**INTRODUCTION TO MACHINE LEARNING** Machine Learning Basics, Need of Machine Learning, Application Domains, Basic Learning Techniques.	Identification of ML Model based on Application
IV	**CLASSIFICATION PROBLEM** Machine learning Algorithms for classification problem	Design decision trees
V	**HANDS ON ACTIVITY :** 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

5. Introduction to Machine Learning, E. Alpaydin. MIT Press
6. Machine Learning, T.M. Mitchell, Mc-Graw Hill
7. Stuart Russell, Peter Norvig, Artificial intelligence : A Modern Approach, Prentice Hall, Fourth edition, 2020.
8. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill.

SEMESTER – V

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 5**	**Course Category**	**SEC**
Course Code	**23SS553**	**Course Title**	**Presentation Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO):-

- TO1. To develop the public speaking skills in the student.
- TO2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
- TO3. 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:

- TLO1. To be confident in presenting himself in front of audience.
- TLO2. To become professional in his approach towards work culture.
- TLO3. To enhance the level communication skills while interacting with others.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3
TO1	√	√	
TO2		√	
TO3		√	√

Unit	Course Contents	Student Engagement Activity
Unit-I	**Importance of Presentation Skills** • 4 P's of presentation skills – plan, prepare, practice & present • Guidelines for effective presentation	PPT Presentation Activity
Unit-II	**Storytelling Skills** • 4 P's of storytelling skills – people, place, plot & purpose • Types of storytelling techniques • Importance of storytelling skills	Start From Where I Stopped Activity
Unit-III	**Corporate Culture Etiquettes** • Importance of professional behavior at work place • Understand & implementation of etiquettes at work place • Importance of values & ethics • Types of professional / corporate etiquettes	Etiquettes Role Play Activity
Unit-IV	**Debate / Extempore** • Difference between debate, extempore & group discussion • Learning argument /counter argument in debate	Current Affair Topic Speech Activity

Unit-V	**Art of Creating Impression** • Importance of creating first impression • 6 ways to master the art of creating impression	Speech Activity
Unit-VI	**Problem Solving** • Types of problems & its solutions Problem solving process & tools	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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 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: 24CS0301A	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination: 30 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 system.
2. Explain the energy harvestings in wearable device.
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	**INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS** 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.
UNIT-II	**SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES** 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, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.
UNIT-III	**WIRELESS HEALTH SYSTEMS** Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.
UNIT-IV	**APPLICATIONS OF WEARABLE SYSTEMS** Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TEXT BOOKS

- Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
- Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013
- Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014
- Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCE BOOKS / RESOURCES

- Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.
- Guang-Zhong Yang, Body Sensor Networks, Springer, 2006.

SEMESTER – VI

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 6**	**Course Category**	**SEC**
Course Code	**23SS654**	**Course Title**	**Professional Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To encourage students to learn and apply the effective writing skills.
- TO2. To make the students learn various types of business correspondence letters, cover letters & resume.
- TO3. To encourage students to learn as to how to talk and convince people in GD & interview.
- TO4. To make the students learn to build rapport for building positive relationships professionally at workplace.

Training Learning Outcomes (TLO): -
After the completion of the training, the student will have ability:

- TLO1. To understand the importance of professional writing required in workplace.
- TLO2. To explore different formats in resume, cover letters & other business related letters.
- TLO3. To develop knowledge, skills and understanding people in-group and individually.
- TLO4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3	TLO4
TO1	√			
TO2	√	√		
TO3		√	√	√
TO4.			√	√

Unit	Course Contents	Student Engagement Activity
Unit-I	**Email Writing** • Importance of email communication skills • Basic rules of effective email writing • Structure of email – address, subject, message text, attachments, signature	Email Practice Activity
Unit-II	**Resume Writing** • Difference between Resume, CV & Bio data • Guidelines of resume writing • Resume preparation of the student	Resume Making Activity

Unit-III	**Letter Writing** • Types of Letter Writing – Application, Leave, etc. • Cover letter	Letter Writing Activity
Unit--IV	**Group Discussion (GD)** • Characteristics of GD & subject knowledge • Do's & Don'ts in GD • Strategies of GD • Types of GD	Group Discussion Practice Activity
Unit-V	**Interview Skills** • Preparation of the interview & company details information • Do's & Don'ts in interview • Types of Interviews • Strategies of interview	Mock Interview Practice Activity
Unit-VI	**Negotiation Skills** • Importance of negotiation skills • Four phases of negotiation skills • Barriers to negotiation & overcoming it • Win-win negotiation	Win-Win Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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		

Data Analytics Tools	
Course Code: 24CS0302D	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination: 30 Marks
L T P :0 0 2	
Credits: 1	

COURSE OBJECTIVE

6. To provide an understanding of the fundamental concepts and processes of data analytics.
7. To introduce students to R and R-Studio, and teach basic data types and structures in R.
8. To equip students with skills for importing, exporting, and performing exploratory data analysis (EDA) in R.
9. To familiarize students with report generation tools like Google Data Studio and Tableau, focusing on creating interactive dashboards.
10. To enable students to apply their knowledge through hands-on activities and case studies, enhancing their practical skills in data analytics.

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:

11. Demonstrate an understanding of the basic principles and processes of data analytics.
12. Utilize R and R-Studio to handle basic data types and structures, and perform fundamental operations.
13. Import, export, and clean data in R, and conduct exploratory data analysis (EDA) using descriptive statistics and data visualization techniques.
14. Create interactive reports and dashboards using Google Data Studio and Tableau, effectively visualizing data insights.
15. Apply data analytics tools and techniques to real-world datasets through hands-on projects, presenting and interpreting their findings accurately.

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

CLO / CO	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

COURSE CONTENTS

UNIT NUMBER	COURSE CONTENTS
UNIT-I	**Introduction to Data Analytics** 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
UNIT-II	**Foundations of R and Data Structures** 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
UNIT-III	**Data Handling and Exploratory Analysis in R** 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
UNIT-IV	**Interactive Data Visualization Tools : Google Data Studio / Tableau / Any other** Introduction, Creating an account/installation, Connecting to data sources, Building basic visualizations, Creating interactive dashboards;
UNIT-V	**Hands-On Activity / Case Study** 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

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

- 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.
- Adler, J. (2010). R in a Nutshell: A Desktop Quick Reference. O'Reilly Media.
- Few, S. (2013). Information Dashboard Design: Displaying Data for At-a-Glance Monitoring. Analytics Press.
- Google. (n.d.). Google Data Studio Help Center. Retrieved from https://support.google.com/datastudio/answer/6283323?hl=en
- Google. (n.d.). Introduction to Data Studio. Coursera. Retrieved from https://www.coursera.org/learn/google-data-studio

SEMESTER – VII

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**4 / 7**	**Course Category**	**SEC**
Course Code	**23AR755**	**Course Title**	**Aptitude & Reasoning**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make student 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) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
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 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	
Text Books	***Quantitative Aptitude for Competitive Examinations*** by R S Aggarwal: S Chand Publishing, 2022.
	A Modern Approach to Logical Reasoning 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		

ESSENTIALS OF BLOCKCHAIN & IOT	
Course Code: 24CS0401D	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 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 Block chain 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 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**
TO1	√			
TO2		√		
TO3			√	√

TRAINING CONTENTS

MODULE	**TRAINING CONTENT**	**STUDENTS ENGAGEMENT ACTIVITY**
I	**CONSENSUS** 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
II	**BITCOIN** Bitcoin Introduction, Wallet - Blocks - Merkley 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.
III	**Introduction to IoT:** Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking, Sensing: Sensors and Transducers, Sensor Classes, Sensor Types, Actuation: Actuator Basics, Actuator Types. **Connectivity Technologies:** ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, ISA100.11a.	To identify the types and characteristics of Sensors

MODULE	TRAINING CONTENT	STUDENTS ENGAGEMENT ACTIVITY
IV	**Introduction to Arduino**: 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	**HANDS ON ACTIVITY** The students will design an application for 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	**1st Year/1st Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC101**	**Course Title**	**Statistical Methods**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Basic Mathematics		**L T P : 2 0 2**	**Credits: 3**

Course Objectives (CO) - The Course is designed with the following objectives:
1. To introduce the basics of statistics and graphical representation of data
2. To equip the students with measures of central tendency and dispersion
3. To learn about correlation and regression analysis
4. To know about the probability in daily life

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. Understand the basics of statistics and explain data for graphical representation
2. Understand the concept of measures of central tendency and measures of dispersion
3. Understand the basics of correlation and regression
4. Understand the concept of probability in real life scenario

Mapping Matrix between Course Objectives and Course Learning Outcomes:

CLO / CO	CL 1	CL 2	CL 3	CL 4
CO 1	✓			
CO 2		✓		
CO 3			✓	
CO4				✓

COURSE CONTENTS:

Unit-I: Introduction to Statistics

Importance of statistics, concepts of statistical population and a sample, data collection methods, primary and secondary data, primary and secondary data. Designing a questionnaire, types of data– quantitative and qualitative data. Measurement scales –Nominal, Ordinal, Interval and Ratio. Classification and tabulation of data, Diagrammatic and Graphical representation of data.

Unit -II: Univariate Data Analysis

Measures of Central Tendency- mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis.

Unit-III: Bivariate Data Analysis

Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's and Kendall's measures. 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

Unit -IV: Probability

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.

Practical/Lab Work to be performed in Computer Lab

Department of Environmental Sciences			
Program: UG program			
Year/Semester	1s 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**

The practical will be taught using Excel software and/or using some statistical software like R /SPSS. Students are encouraged to use resources available on open sources.

- Graphical representation of data.
- Practical based on measures of central tendency.
- Practical based on measures of dispersion.
- Practical based on combined mean and variance and coefficient of variation.
- Practical based on moments, skewness, and kurtosis.
- Fitting of polynomials, exponential curves.
- Karl Pearson correlation coefficient.
- Correlation coefficient for a bivariate frequency distribution.
- Lines of regression, angle between lines and estimated values of variables.
- Problems based on conditional probability and Baye's theorem

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 7th Edition R for beginners by Emmanuel Paradis (Freely available) at https://cran.rproject.org/doc/contrib/Paradisrdebuts_en.pdf)

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 the 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 LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**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

MANAGEMENT AND ORGANISATIONAL BEHAVIOUR	
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

- To help students understand the conceptual framework of management and organizational behaviour and correlate them to manage 21st century organizations.
- To develop understanding about management and Applicability in the corporate world.
- To enhance and develop the skills and competencies to understand the complexities of business problems.
- To understand, retain and recall the basics of management.
- To make them aware about the current scenario and identify themselves in terms of adaptability.
- 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:

- Understand the concept of management
- Learn about different management skills requirements for the corporate world.
- Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.
- Understand the human behaviour and its contribution at work place
- Understand the competitiveness in businesses.

COURSE CONTENT

UNIT	CONTENTS
UNIT-I	***Fundamentals of Management and Evolution of Management Thought***: 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.

UNIT-II	***Managerial Functions and Social Responsibility of Managers****:* 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
UNIT-III	***Introduction to Organisational Behaviour****:* 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.
UNIT-IV	***Work Motivation and Group Behaviour****:* 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.
UNIT-V	***Leadership, Organisation Culture, Conflict Management:*** 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.

References:

1. Luthans Fred (2015): Organizational Behavior, Tata McGraw Hill. (12th Edition)
2. Stephen, P Robbins (2009): Organizational Behavior, Prentice Hall of India Private Limited, New Delhi.
3. Koontz & Heinz Weihrich: 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.

Management Process and Organizational Behaviour	
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 Objectives (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, 16th edition (2012), Pearson Education.
2. K. Aswathappa, Organizational Behaviour, 13th edition (2016), Himalaya Publishing House.
3. Fred Luthans, Organizational Behavior, 14th 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, 6th edition (2011), McGraw-Hill.

Year/Semester	3rd / 4th	Course Category	MDC
Course Code	23MDC302	Course Title	Library Information Science & Media Literacy
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

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:

	CO-1	CO-2	CO-3	CO-4
CLO-1	√			
CLO-2		√		
CLO-3			√	
CLO-4				√

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, 5th Edition. ISBN-9781783304776, Facet Publication, UK
2. https://en.unesco.org/themes/media-and-information-literacy/resources

COMPUTER-BASED NUMERICAL AND STATISTICAL TECHNIQUES	
Course Code: 24MDC101A	Internal Examination: 40 Marks
Credits: 3	External Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Engineering Mathematics – III	

COURSE OBJECTIVES (COs)

1. To familiar with different operators which are useful in Numerical Analysis and introduce the concept of interpolation.
2. To Familiar with numerical solutions of algebraic, transcendental and simultaneous equations. Also introduce numerical differentiation and integration with applications.
3. Familiarize with numerical solutions of ordinary differential equations.
4. To equip the students with the knowledge of basic probability, Random variables, discrete as sell 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. Get exposed to finite differences and interpolation.
2. Get numerical solution of equations and find the numerical differentiation and integration.
3. Demonstrate the numerical solutions of ordinary differential equations by different methods.
4. Implement the probability concepts and the corresponding distributions and compute correlation coefficients and regression lines.

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: Finite Differences and Interpolation

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.

Unit-II: Numerical Solution of Equations, Differentiation and Numerical integration 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.

Unit-III: Numerical Solutions of Ordinary Differential Equations

Solution by Taylor's series - Euler's method, Modified Euler method - Runge-Kutta methods of second and fourth orders.

Unit-IV: Statistics

Introduction, Measures of Central tendency and dispersion , Moments - Skewness and kurtosis based on moments..

TEXT BOOKS/REFERNCE BOOKS

1. Grewal, B.S., Numerical Methods, Khanna Publishers, 6th edition,
2. Sastry, S.S., Introductory Methods of Numerical Analysis, PHI New Delhi , 2007
3. Balagurusamy, E. , Computer Oriented Statistical and Numerical Methods - TMH, 2000
4. Jain, M.K. Iyengar, S.R.K. and Jain, R.L., Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 1987
5. Gupta, S.C. and Kapoor,V.K., Fundamental of Mathematical Statistics, S. Chand, New Delhi, 2017

PROBABILITY & RANDOM PROCESS	
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 process 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 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)

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

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, Coditional 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; 2nd Edition, 2001.

BIOSTATISTICS	
Course Code: 24MDC101C	ContinuousEvaluation: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 as 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 hypothesis.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUT COMES (CLOs)

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01	✓			
CO-02		✓		
CO-03			✓	
CO-04				✓

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,9th Edition, Prentice Hall,2017.

NUMERICAL METHODS	
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 theconcept of interpolation

COURSE LEARNING OUTCOMES (CLOs)

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

1. Find solutions by various numerical methods to get approximation solutions of algebraic a 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'sInterpolation 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

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TEXT BOOKS/ REFERENCE BOOKS

1. B.S. Grewal, "Numerical Methods in engineering and science", Khanna Publishers, 42ndEdition, 2015.
2. Steven Chapra and Raymond Canale, Numerical Methods for Engineers, 8th Edition, McGrawHill, 2020.
3. M.K. Venkataraman, Numerical Methods in Science and Engineering, NationalPublishing Co., 1999
4. Gerald C. F., Wheatley P. O., Applied Numerical Analysis, Pearson, 2011.
5. Arumugam S., Isaac A. T., Somasundaram A., Numerical Methods, ScitechPublications 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.

NUMERICAL METHODS IN BME	
Course Code: 24MDC106A	Internal Examination: 40 Marks
Credits: 3	External Examination: 60 Marks
L T P : 3 0 0	
Prerequisite:	

COURSE EDUCTIONAL 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 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 theconcept 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 algebraica 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 EDUCTIONAL OBJECTIVES (CEOs) AND COURSE LEARNING OUTCOME (CLOs)

CLO / CEO	CLO-01	CLO-02	CLO-03	CLO-04
CEO-01	✓			
CEO-02		✓		
CEO-03			✓	
CEO-04				✓

COURSE CONTENTS

Unit-I: Error in Computation 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 ,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.

Unit-II: Interpolation with Equal and Unequal Interval

Finite differences - Forward differences and backward differences, difference tables, Interpolationwith equal intervals: Newton- Forward and Backward Interpolation formulae, Interpolation with unequal interval: Divided differences - Newton's Divided difference formula - Lagrange'sInterpolation formula.

Unit-III: Numerical Differentiation and Integration

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.

Unit-IV: Numerical Solutions of Differential Equations

Solution by Taylor's series - Euler's method - Improved and modified Euler method - Runge-Kutta methods of fourth order (No proof).

TEXT BOOKS / REFERENCE BOOKS

1. B.S. Grewal, "Numerical Methods in engineering and science", 11th Edition MercuryLearning and Information, 2018.
2. Steven Chapra and Raymond Canale, Numerical Methods for Engineers, McGraw-HillEducation, 8th edition 2020.
3. Gerald C. F., Wheatley P. O., Applied Numerical Analysis, Pearson, 2011.
4. Arumugam S., Isaac A. T., Somasundaram A., Numerical Methods, Scitech Publications Pvt.Ltd, 2010.
5. S.S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition 2012
6. E. Balagurusamy, Computer Oriented Statistical and Numerical Methods -LaxmiPublications,2009.
7. M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and EngineeringComputation, NEW AGE; 6th edition, 2019.
8. P.Kandasamy, Numerical Methods, S Chand & Company; Reprint Edition, 2006.

DISCRETE MATHEMATICS	
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 thatimpart analytical ability to describe, analyze and solving mathematical problems
2. To get 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 andsystematic fashion

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion 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, ringsand fields.
4. Get idea of Boolean algebra and its applications.

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: 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 - Karanugh 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, 6thedition.,Pearson'sPublication,2017.
2. Sarkar S. K., Discrete Mathematics, S Chand & Co Ltd2016. Prentice Hall India LearningPrivate Limited; Second edition, 2014.
3. Keneth H. Rosen, Discrete Mathematics and its application, Tata Mcgraw Hill, 7th edition,2017.
4. Bondy J. A., Murty U. S. R., Graph Theroy, Springer, 2013.
5. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 4th edition,2017.
6. Yadav S. K., Discrete Mathematics with Graph Theory, Anne Books Pvt. Ltd., 2013.

Year/Semester	3rd /5th	Course Category	Multidisciplinary Course (MDC)
Course Code	23MDC301	Course Title	IPR for Business
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P: 3 0 0	Credits: 3

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.

CO 1: To provide students with a basic understanding of various types of IPR and its relevance for business.

CO 2: To acquaint students with the strategies and management techniques associated with intellectual property assets, and the legal considerations and challenges involved.

CO 3: To familiarize the students with the challenges and legal considerations related to intellectual property disputes.

CO 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:

CLO1: Define and discuss about the various types of IPR and its relevance for business

CLO2: Discuss the adjudicating bodies and mechanisms under each of these IPRs

CLO3: Analyze and resolve business disputes relating to IPR

CLO4: Apply the learning to the real-life situations in business

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	CLO1	CLO2	CLO3	CLO4
CO1	√			
CO2		√		
CO3			√	
CO4				√

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

Year/Semester	3rd / 6th	Course Category	Multidisciplinary Course
Course Code	23MDC304	Course Title	Indian Economy
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES

1. To introduce about different demography terms and trends.
2. To make students familiar with growth and its distribution.
3. To discuss the major changes in 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

Course Objectives (COs)	Course Learning Outcomes (CLOs)		
	CLO 1	CLO 2	CLO 3
CO 1			
CO 2			
CO 3			

COURE 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: Indiaand its Contradictions*, Princeton UniversityPress.
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 ofIndian Economy: 1950-2008.AStory of Sustained Savings and Investment, *Economic and Political Weekly*,May.
4. S.L. Shetty, 2007,—India's SavingsPerformancesincethe Advent ofPlanning,in K.L. Krishna and A. Vaidyanathan, editors, *Institutions and Markets in India's Development.*
5. Himanshu, 2010,—TowardsNew Poverty LinesforIndia, *Economicand Political Weekly*,January.

PROBABILITY AND STATISTICS	
Course Code: 24MDC107	Internal Examination: 40 Marks
Credits: 3	External Examination: 60Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To apply the basis rules of probability and gain knowledge of theoretical distributions.
2. To apply the knowledge of Regression lines and analysis of variance.
3. Understand how to develop null and alternative hypothesis and draw conclusions using hypothesis tests.
4. Acquire the knowledge to solve the problem of process control.

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:
- Implement the concept of probability and random variables and model them using various distributions.
- Examine the regression lines and interpret the results in the analysis of variants.
- Infer the results by using hypothesis testing on large and small samples.
- Utilize quality control technique to solve real world problems.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES

CLO / CO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01	✓			
CO-02		✓		
CO-03			✓	
CO-04				✓

COURSE CONTENTS

Unit-I: Probability and Probability Distributions

Introduction, Conditional Probability, Baye's Theorem and its applications, Random Variable, Discrete and Continuous random variables, Binomial, Poisson and Normal distributions.

Unit-II: Correlation, Regression and ANOVA

Correlation and its properties, Karl Pearson's Coefficient of correlation, Spearman's Rank Correlation Coefficient for repeated and non-repeated ranks, Linear regression lines and properties, Introduction to ANOVA, one way and two way classifications.

Unit-III: Testing of Hypothesis

Sampling distribution, Type-I and Type-II errors, large sample test, Test of significance for single proportion, difference of proportion, single mean and difference of means. Small sample test, t-test for single mean, for difference of means.

Unit-IV: Statistical Quality Control

Introduction, Process control, Control charts for variable, $\overline{X}$, R and S charts.

TEXT BOOKS / REFERENCE BOOKS

7. S.Ross, "A first Course in Probabilty", Pearson Education, India, 2010
8. Veera Rajan,T, "Probability and Statistics," TMH, New Delhi-2010
9. V.K.Rohatagi, A.K.Md. Ehsan's Saleh, "An Introduction to Probability and Statistics," Wiley, Oxford, 2nd Ed. 2008.
10. S.C.Gupta and V.K. Kapoor, "Fundamental of Mathematical Statistics", S.Chand ,New Delhi, 2015.

Year/Semester	3rd / 6th	Course Category	MDC
Course Code	23MDC305	Course Title	Electoral Literacy in India
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

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:

Course Learning Objectives (Cos)	Course Learning Outcome (CLOs)				
	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	√				
CO2		√	√		
CO3			√	√	
CO4					√

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

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, 26th 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

Creating Entrepreneurial Mind Set	
Course Code: 23MDC402	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3-0-0	**Course Type:** MDC

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

Course Objectives (COs)	Course Learning Outcomes (CLOs)			
	CLO 1	CLO 2	CLO 3	CLO 4
CO 1				
CO 2				
CO 3				
CO4				

COURSE CONTENTS

UNIT	CONTENTS
UNIT-I	**Basics of Entrepreneurship** Entrepreneur: Definition, characteristics, functions, types of an entrepreneur; Concept of Entrepreneurship, types, role of entrepreneurship in economic development, Factors affecting Entrepreneurship.
UNIT-II	**Entrepreneurial Development Programme** 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.
UNIT-III	**Business Planning** Opportunity Identification and selection, Formulation of business plan, External Environmental Analysis - Economic, Social, financial, technological, competitive, and legal. Financing: Sources, venture capital, export finance.
UNIT-IV	**Entrepreneurial Trends in the Digital Age** Definition and significance of digital entrepreneurship; Brief overview of key digital trends impacting businesses; Disruptive Technologies; Promoting innovation and adaptability in a digital ecosystem

TEXT BOOKS

1. Burns, Entrepreneurship and small business, 4th edition (2016), Palgrave.
2. Norman M. Scarborough, Essentials of entrepreneurship and small business management, 9th edition (2018), Pearson.
3. Hisrich, R., & Peters, M., Entrepreneurship, 11th 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, 7th edition (2017), Tata Mc. Graw Hill.
2. Mullins, J., New business road test, 4th 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.

Year/Semester	3rd / 5th	Course Category	MDC
Course Code	23MDC303	Course Title	Psychology and Emotional Intelligence
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE OBJECTIVES (COs):

CO1: To know the concepts in sociology relevant to the study of society.
CO2: To discuss classical sociological thoughts by sociologists.
CO3: To understand modern and post modern sociological thoughts.
CO4: To grasp the significance of sociological theories in understanding society
CO5: 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:

CLO1: Explain various sociological concepts important in the understanding of society.
CLO2: Application of critical conceptual understanding that is central to sociological investigations.
CLO3: Analyzing the social phenomena with respect to theoretical understanding of society.
CLO4: Recommend analytical as well as methodological understanding to generate authentic knowledge.
CLO5: Integrate the knowledge of social issues in society according to advanced, contemporary, interdisciplinary knowledge.

Mapping Matrix between Course Objectives and Course Learning Outcomes:

CLO / CO	CLO 1	CLO 2	CLO 3	CLO 4	CLO
CO 1	✓				
CO 2		✓			
CO 3			✓		
CO4				✓	
CO5					✓

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

- **MICRO PERSPECTIVE:** Theoretical perspectives: Symbolic Interactionism, Exchange Theory, Labelling Theory

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

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)

PERSONAL FINANCIAL PLANNING	
Course Code: 23MDC403	**Continuous Evaluation**: 40
Credits: 03	**End Semester Examination**: 60
L T P : 3-0-0	**Course Type**: MDC
Prerequisite: Student should be aware about various saving schemes and their future benefits.	

COURSE OBJECTIVES

1. Build an understanding to familiarize different aspect 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 the 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 the insurance and retirement planning with relevance.

MAPPING MATRIX COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

CLO / CO	01	02	03	04
01	√			
02		√		
03			√	
04				√

UNIT	Course contents
UNIT-I	**Introduction to Financial Planning** 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.
UNIT- II	**Investment Planning** 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
UNIT- III	**Personal Tax Planning** 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.
UNIT- IV	**Insurance and Retirement Benefits Planning** Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance, Pension plans available in India

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

Year/Semester	2nd Year/ 3rd Semester	**Course Category**	**VAC**
Course Code	23 VAC 103	**Course Title**	Sports , Yoga & Fitness
Continuous Evaluation : 80		**End Semester Examination : 20**	
Prerequisite: Nil		**L T P :1 0 2**	**Credits: 2**

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 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 TEXONOMY)**

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	**CLO2**	**CLO3**	**CLO4**	**CLO5**
CO1	√				
CO2		√			
CO3			√		
CO4				√	
CO5					√

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
- groupRelationship, 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 Eduction, 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

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 23VAC102/202	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

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 an 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	**1ST/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 LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**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 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.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	**1ST/I or II**	**Course Category**	**Value Added Course (VAC)**
Course Code	**23VAC101/23VAC201**	**Course Title**	Environmental Protection & Sustainable development
Continuous Evaluation: 70		**End Semester Examination: 30**	
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 LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**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; 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

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 3**	**Course Category**	**SEC**
Course Code	**23SS351**	**Course Title**	**Effective Communication Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

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, engaging, assessing and re 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) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
TO1	√		
TO2	√	√	
TO3		√	√

Unit	**Course Contents**	**Student Engagement Activity**
Unit-I	**Verbal Communication Skills** • Communication Process & its importance • 7 C's of Communication • Formal & Informal Conversation • Requirements of effective verbal communication	Conversation Cards Activity

Unit-II	**Nonverbal Communication Skills** • Importance of nonverbal skills in effective communication • Types of nonverbal (body language) skills • Barriers to nonverbal communication	Power of Body Language Activity
Unit-III	**Listening Skills** • Role of listening skills in effective communication • Barriers to listening • Overcoming listening barriers • Empathetic listening & avoiding selective listening	Chinese Whisper Activity
Unit-IV	**Reading & Writing Skills** • Types of reading strategies to enhance improve reading skills • Types of written communication	The What IF Activity
Unit- V	**Visual Communication** • Types of visual communication • Importance of visual communication • Picture narration/description technique	Interpret The Picture Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 4**	**Course Category**	**SEC**
Course Code	**23SS452**	**Course Title**	**Teamwork & Interpersonal Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To make the students learn & demonstrate effective teamwork, leadership

  & interpersonal skills.
- TO2. To equip the students with capability of handling stress and utilization of work time effectively.
- TO3. 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:

- TLO1. To be confident working in a team and leading it as well.
- TLO2. 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.
- TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3	TLO4
TO1	√			
TO2		√		
TO3			√	√

Unit	Course Contents	Student Engagement Activity
Unit - I	**Team Management** • Team communication & team conflict resolution • Role of a team leader • Team goal setting & understanding team development • Team dynamics & multicultural team activity • Johari Window Model	Collaborative Working Game Activity
Unit-II	**Time Management** • Time management matrix • Pareto Principle (80/20 rule) • Development process of plan of action	What You Did Yesterday Activity
Unit-III	**Leadership** • Difference between leadership & management • Types of leadership style • Core leadership skills	Lead The Blindfolded Activity
Unit-IV	**Stress Management** • Sign of stress & its impact • Types of stress • Techniques of handling stress	Keeping Cool Activity
Unit - V	**Emotional Intelligence** • Emotional intelligence & emotional competence • Components & behavioral skills of emotional intelligence	Guess The Emotion Game Activity
Unit - VI	**Critical Thinking** • Types of thinking & Characteristics • Critical thinking standards • Barriers to critical thinking	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 5**	**Course Category**	**SEC**
Course Code	**23SS553**	**Course Title**	**Presentation Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO):-

- TO1. To develop the public speaking skills in the student.
- TO2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
- TO3. 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:

- TLO1. To be confident in presenting himself in front of audience.
- TLO2. To become professional in his approach towards work culture.
- TLO3. To enhance the level communication skills while interacting with others.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)

Training Learning Outcomes (TLO) Training Objectives(TO)	TLO1	TLO2	TLO3
TO1	√	√	
TO2		√	
TO3		√	√

Unit	Course Contents	Student Engagement Activity
Unit-I	**Importance of Presentation Skills** • 4 P's of presentation skills – plan, prepare, practice & present • Guidelines for effective presentation	PPT Presentation Activity
Unit-II	**Storytelling Skills** • 4 P's of storytelling skills – people, place, plot & purpose • Types of storytelling techniques • Importance of storytelling skills	Start From Where I Stopped Activity

	Corporate Culture Etiquettes	
Unit-III	• Importance of professional behavior at work place • Understand & implementation of etiquettes at work place • Importance of values & ethics • Types of professional / corporate etiquettes	Etiquettes Role Play Activity
Unit-IV	**Debate / Extempore** • Difference between debate, extempore & group discussion • Learning argument /counter argument in debate	Current Affair Topic Speech Activity
Unit-V	**Art of Creating Impression** • Importance of creating first impression • 6 ways to master the art of creating impression	Speech Activity
Unit-VI	**Problem Solving** • Types of problems & its solutions Problem solving process & tools	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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 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

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 6**	**Course Category**	**SEC**
Course Code	**23SS654**	**Course Title**	**Professional Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To encourage students to learn and apply the effective writing skills.
- TO2. To make the students learn various types of business correspondence letters, cover letters & resume.
- TO3. To encourage students to learn as to how to talk and convince people in GD & interview.
- TO4. To make the students learn to build rapport for building positive relationships professionally at workplace.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the importance of professional writing required in wor kplace.
- TLO2. To explore different formats in resume, cover letters & other business related letters.
- TLO3. To develop knowledge, skills and understanding people in-group and individually.
- TLO4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)

Training Learning Outcomes (TLO) ⍰ Training Objectives(TO)⍰	TLO1	TLO2	TLO3	TLO4
TO1	√			
TO2	√	√		
TO3		√	√	√
TO4.			√	√

Unit	Course Contents	Student Engagement Activity
Unit-I	**Email Writing** • Importance of email communication skills • Basic rules of effective email writing • Structure of email – address, subject, message text, attachments, signature	Email Practice Activity
Unit-II	**Resume Writing** • Difference between Resume, CV & Bio data • Guidelines of resume writing • Resume preparation of the student	Resume Making Activity
Unit-III	**Letter Writing** • Types of Letter Writing – Application, Leave, etc. • Cover letter	Letter Writing Activity
Unit--IV	**Group Discussion (GD)** • Characteristics of GD & subject knowledge • Do's & Don'ts in GD • Strategies of GD • Types of GD	Group Discussion Practice Activity
Unit-V	**Interview Skills** • Preparation of the interview & company details information • Do's & Don'ts in interview • Types of Interviews Strategies of interview	Mock Interview Practice Activity
Unit-VI	**Negotiation Skills** • Importance of negotiation skills • Four phases of negotiation skills • Barriers to negotiation & overcoming it Win-win negotiation	Win-Win Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** 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		

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**4 / 7**	**Course Category**	**SEC**
Course Code	**23AR755**	**Course Title**	**Aptitude & Reasoning**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make student 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) TRAINING OBJECTIVES (TO)	TLO1	TLO2	TLO3
TO1	√		
TO2		√	
TO3			√

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	
Text Books	***Quantitative Aptitude for Competitive Examinations*** by R S Aggarwal: S Chand Publishing, 2022.
	A Modern Approach to Logical Reasoning 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		