NAAC GRADE A+
ACCREDITED UNIVERSITY

REVA UNIVERSITY
Bengaluru, India

HANDBOOK

B. Tech.

Computer Science and Engineering (IoT & Cyber Security including Blockchain Technology)

Academic Year 2024-28

RUKMINI EDUCATIONAL
Charitable Trust

www.reva.edu.in

Chancellor’s Message

“Education is the most powerful weapon which you can use to change the world.”

- Nelson Mandela.

At REVA University, we are firm believers in this truth.
The power of education lies not only in the acquisition of knowledge but in its ability to transform lives, communities, and nations. As the world rapidly evolves, driven by technological advancements and global interconnectedness, education remains the catalyst for progress, innovation, and positive change.

Today, we live in an era where knowledge is no longer confined to books or classrooms. Information is accessible at the touch of a button, and opportunities for learning abound in every corner of the world. Yet, the true essence of education lies beyond the mere accumulation of information. It is about cultivating critical thinking, fostering creativity, and empowering individuals to contribute meaningfully to society. At REVA University, we are committed to nurturing seekers of knowledge who aspire to make a difference in the world.

Guided by our founding philosophy of "Knowledge is Power," we strive to create an environment where intellectual curiosity is encouraged, and dreams are transformed into reality. India is a land of immense talent and potential, and it is our duty as educators to provide the spark that ignites this potential. Through the transformative power of education, we aim to shape future leaders who possess not only technical proficiency but also strong ethical values and a commitment to social responsibility.

A university is more than just a place of learning; it is a place of growth, exploration, and transformation. Our faculty, with their expertise and dedication, are at the heart of this transformation. They are more than teachers; they are mentors who guide students on their journey of self-discovery and academic excellence. Our student-centric, transformational approach ensures that every learner is given the opportunity to explore their full potential and exceed their own expectations.

At REVA University, we take great pride in our state-of-the-art infrastructure and facilities, designed to provide an inspiring and conducive environment for both academic and extracurricular pursuits. Our campus is a vibrant space where students are encouraged to challenge their minds, develop their skills, and grow as individuals.

As we move forward, I am reminded of the words of Benjamin Disraeli: "A university should be a place of light, of liberty, and of learning." This vision continues to inspire us at REVA University, where we work as a team to create a brighter future for our students and our society.

I invite you to join us on this journey of enlightenment, growth, and transformation. Together, let us lay the foundation for a future built on values, wisdom, and knowledge.

Dr. P. Shyama Raju
Chancellor
REVA University

Pro Chancellor's Message

REVA University has emerged as a premier destination for higher education across diverse fields such as engineering, science, commerce, management, architecture, law, arts, and humanities. Our commitment to excellence in education is reinforced by the adoption of cutting-edge technologies and innovative teaching methods that ensure our students are equipped for the future.

The integration of modern tools and ICT-based technologies is at the core of our academic philosophy. We focus on digital learning, project-based learning, and personalized learning experiences that cater to individual student needs. By harnessing the power of advanced technologies such as AI-powered learning platforms, data analytics, and virtual/augmented reality, we are able to offer dynamic, interactive educational experiences that transcend traditional classroom boundaries. This technological transformation enables us to deliver STEM education more effectively while providing our faculty with ongoing professional development to stay at the forefront of teaching innovations.

Our programs are meticulously designed after a thorough analysis of current industry needs and trends, with a focus on knowledge assimilation, practical application, and global employability. We recognize the importance of preparing students not just for today's job market but for a rapidly changing future where automation, artificial intelligence, and data-driven decision-making will play pivotal roles. To meet these demands, we emphasize hands-on learning, skill development, and innovation, ensuring that our students are well-prepared to thrive in their respective fields.

At REVA University, we have implemented the Choice Based Credit System and Continuous Assessment Grading Pattern (CBCS – CAGP) in all our programs. This system provides students with the flexibility to choose subjects that align with their interests while developing essential skills. CBCS courses integrate knowledge on local, regional, national, and global issues, fostering a comprehensive understanding of the world and enabling students to become entrepreneurial and employable in a competitive global marketplace. Furthermore, students are offered a variety of value-added courses to enhance their skillsets, ensuring they are equipped to navigate the evolving demands of their chosen careers.

The future of the engineering profession, and indeed many other fields, will be shaped by dramatic technological and societal changes. The rise of automation, sustainability concerns, and increased globalization will create both opportunities and challenges for the next generation of professionals. REVA University is fully prepared to meet these challenges head-on. Through state-of-the-art laboratories, research centers, and partnerships with premier industries and academic institutions, we are committed to creating talented professionals and leaders who can navigate these future transformations.

Our growth and success have been built on a foundation of excellence in curriculum design, student-centric teaching methods, and hands-on learning practices. I extend my gratitude to our students, parents, faculty, staff, and well-wishers for their contributions in helping REVA University become a next-generation, globally recognized education hub.

Mr. Umesh S. Raju
Pro Chancellor
REVA University

Vice Chancellor's Message

The last two decades have seen remarkable growth in higher education in India and across the globe. The move towards interdisciplinary studies and interactive learning has opened up several options as well as created multiple challenges.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing young human resources on the foundation of ethical and moral values while boosting their leadership qualities, research culture and innovative skills.

Built over 50 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to a higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programmes are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of a student-centric learning environment through innovative pedagogy, form the backbone of the University. All the programmes offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach.

The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Benchmarked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think tanks - a large number of faculty members, experts from industries and research-level organizations.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research-level organizations like STI HUB, ISRO, DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs. With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our commitment to providing premium quality education accessible to all and an environment for the growth of overall personality development leading to generating "GLOBAL PROFESSIONALS".

Dr. N. Ramesh
Vice Chancellor (I/C), REVA University

Director’s message

Congratulations and welcome all new students to the prestigious school of Computer Science and Engineering. The school has a rich blend of experienced and energetic faculty who are well-qualified in various aspects of Electronics, and Computer Science. The school possesses numerous state-of-the-art digital classrooms and laboratories having contemporary computing equipment, including cloud-based systems. The school offers B.Tech. in Computer Science and Engineering, B.Tech in Artificial Intelligence and Data Science, B. Tech in Computer Science and Engineering (Internet of Things and Cyber Security including Block Chain Technology), M.Tech in Computer Science and Engineering (Full Time) and M.Tech in Computer Science and Engineering (Part-Time). In addition, the school has a research center in which a student can conduct cutting-edge research leading to a Ph.D. degree. The faculties pursueresearch in areas like Data Mining, Healthcare Systems, Blockchain, Wireless Networks, Cloud Computing, Image Processing, Software Architecture, and Machine Learning Applications.

Curricula of both undergraduate and postgraduate programmes have been designed through a collaboration of alumni, academic, research, and industry experts to bridge the gap between industry and academia and inculcate innovation and leadership qualities. This makes the programme highly practical and industry-oriented. The B.Techprogramme aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world. The Master's Degree focus on quality research and design in the core and applicationareas to foster a sustainable world and enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters’ programmes. Research degree programmes aim to design and develop solutions to contemporary computer and engineering technologies oriented towards human development.

Welcome to the school of Computer Science and Engineering at REVA University for better learning and becoming future leaders for the nation's socio-economic growth and the world.

Dr. Ashwinkumar U Motagi

Director, School of CSE

Rukmini Educational Charitable Trust

In October 2005, the long-standing dream of Smt. Rukmini Shyama Raju to educate the youth became a reality with the establishment of Rukmini Educational Charitable Trust (RECT). The RECT is a Charitable Trust to promote, establish, and conduct developmental activities in the fields of Arts, Commerce, Engineering, Environmental Science, Management, Science & Technology, Law, Architecture, Performing Arts, and others.

To meet this aim, the Trust has set up the REVA Group of Educational Institutions comprising REVA Institute of Technology and Management, REVA Institute of Science and Management, REVA Institute of Management Studies, REVA Institute of Education, REVA First Grade College, REVA Independent PU College Kattigenahalli, REVA Independent PU College-Ganganagar, and REVA Independent PU College Sanjaynagar, and REVA University. Through these institutions, the Trust seeks to fulfil its vision of providing world-class education and creating abundant opportunities for the youth to excel in academics.

Every great human enterprise is powered by the vision of extraordinary individuals and is sustained by the people who derive their motivation from the founders. Dr. P. Shyama Raju, the Chairman of the Trust, is a developer and builder of repute, a captain of the industry in his own right, and the Chairman & Managing Director of the DivyaSree Group of companies. The other trustees are Shri Bhaskar N Raju, and Smt Arathi B. Raju, Shri. Umesh. S. Raju and Smt. Tanisha U. Raju.

The Rukmini Educational Charitable Trust is driven by the purpose of nurturing students who are in pursuit of quality education and excellence. REVA, today, is a family of 10 institutions providing education from pre-university to post-graduation and providing research and resource support to PhD degree aspirants.

About REVA University

REVA University is a State Private University established in Karnataka State under the Government of Karnataka Act No. 13 in the year 2012 in Bengaluru, the IT capital of India. REVA University, recognised by the University Grants Commission (UGC) and approved by the All India Council for Technical Education (AICTE), has an A+ grade from NAAC. The University has a sprawling green campus spread over 43 acres of land.

The University has a DIAMOND Band ranking from QS I Gauge. As per QS Asian University Rankings, it is ranked 47th among all the private Universities of India and 6th among all private universities of Karnataka. In less than a decade, REVA University, Bengaluru, has established itself as a Global University in education by earning recognition as a forward-thinking institution across all disciplines.

The University currently offers 38 full-time undergraduate Programmes, 33 full-time postgraduate programmes, 20 Ph.D. programmes, and certification and diploma programmes. The University offers programmes under the faculty of Engineering, Architecture, Science and Technology, Commerce, Management Studies, Law, Arts & Humanities, and Performing Arts & Indic Studies. REVA offers some of the trending fields of study as undergraduate courses in Sports Science (B. Sc.), Agricultural Engineering (B. Tech), and Aerospace Engineering (B. Tech) which are full-time application-based programmes with a unique blend of theory and practical components.

With state-of-the-art infrastructure, the University has created a vibrant academic environment conducive to higher learning and research. This includes 200 smart classrooms that support blended learning, real-industry-like labs that foster on-the-job learning in students, a tech-enabled library with over 1 lakh collections of books, and most importantly, modern pedagogy. REVA currently has numerous students on campus from around the country. The campus has exclusive Halls of Residence which provides comfortable accommodation for boys and girls, apart from catering to the needs of all cuisine and ensuring adequate amenities are provided to make their stay an extended home.

In its mission to become a social impact university, REVA University has initiated several Corporate Social Responsibility initiatives. Jagruti, Abhivriddhi, Vanamahotsava, Education on Wheels, and Pragna are a few of the several projects in REVA. REVA has now moved on to become a Social Impact University and has aligned with the United Nations Sustainable Development Goals. Through these initiatives, REVA aspires to become an innovative University by developing a social connection with leadership qualities, ethical and moral values, research culture, and innovative skills through higher education of global standards.

Vision

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standard.

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

REVA UNIVERSITY

Bengaluru, India

ACADEMIC REGULATIONS

B. Tech., Degree Programs

(Applicable for the programs offered from 2024-25)

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

THESE ACADEMIC REGULATIONS ARE UNDER CHOICE BASED CREDIT SYSTEM AND CONTINUOUS ASSESSMENT GRADING PATTERN (CBCS-CAGP)

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – B. Tech., Degree Program for the batch of students admitted for AY 2024-25 subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management"**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

2. The Programs:

These regulations cover the following B. Tech., Degree programs of REVA University offered for the admitted batch during AY 2024-25 under respective schools.

SL No.	Name of the School	Name of the Program
1	School of Civil Engineering	B Tech in Civil Engineering
2	School of Computing and Information Technology	B Tech in Computer Science and Engineering (Artificial Intelligence and Machine Learning)
		B Tech in Computer Science and Information Technology
		B Tech in Information Science and Engineering
		B Tech in Computer Science and Systems Engineering
3	School of Computer Science and Engineering	B Tech in Computer Science and Engineering
		B Tech in Artificial Intelligence and Data Science
		B Tech in Computer Science and Engineering (Internet of Things and Cyber Security including Blockchain Technology)
4	School of Electrical and Electronics Engineering	B Tech in Electrical and Electronics Engineering
5	School of Electronics and Communication Engineering	B Tech in Electronics and Communication Engineering
		B Tech in Electronics and Computer Engineering
		B Tech in Robotics and Artificial Intelligence
6	School of Mechanical Engineering	B Tech in Mechanical Engineering
		B Tech in Mechatronics Engineering
		B.Tech in Aerospace Engineering
7	Department of Agricultural Engg.	B Tech in Agricultural Engineering

3. Duration and Medium of Instructions:

3.1 Duration: The duration of the B Tech degree program shall be **FOUR** years comprising of **EIGHT** Semesters. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both and project, listed under a program; Example: "Fluid Mechanics" in B. Tech Civil Engineering program, "Signals and Systems" in B. Tech., Electronics and Communication Engg are the examples of courses to be studied under respective programs.
Every course offered will have three components associated with the teaching-learning process of the course, namely, L, T and P, where,

L stands for **Lecture** session consisting of classroom instruction.
T stands for **Tutorial** session, an Interactive session including discussions, self-study, desk work, seminar presentations, and other methods to deepen understanding.
P stands for **Practice** session and it consists of hands-on experience such as laboratory experiments, field studies, case studies, project based learning or course end projects and self-study courses that equip students to acquire the required skill component.

4.2 Classification of Courses

Courses offered are classified as follows:

4.2.1 Foundation Course (FC): The foundation Course is basic course which should be completed successfully as a part of graduate degree program irrespective of the program of study.

4.2.2 Professional Core Course (also known as Hard Core (HC) Course): The **Professional Core** is a core course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily.

4.2.3 Professional Elective Course (also known as Soft Core (SC) Course): Professional Elective course is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

4.2.4 Open Elective Course (OE): An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course.**

4.2.5 Audit Course (also known as Non-Credit Course /Mandatory Course (MC)): These courses are mandatory for students joining B.Tech. Program and students have to successfully complete these courses before the completion of degree.

4.2.6 Project Work / Dissertation: Project work / Dissertation work is a special course involving application of knowledge in solving / analysing /exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems. The project will be conducted in two phases, phase-I, consists of literature survey, problem identification, formulation and methodology. In Phase-II, student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated.

4.2.7 **Skill Development Course (SDC):** It is a practice based course introduced in first year, second year and third year that lead to advanced job skills as per current industry/societal requirements to enhance high employability index of graduates. It may also lead to a certificate, diploma and advanced diploma, etc.

4.2.8 **Emerging Technology Course (ETC):** This course is introduced in the first year, focusing on the latest advancements and innovations in technology. It aims to equip students with cutting-edge knowledge and skills relevant to emerging fields.

4.3 "Program" means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma Degree or such other degrees instituted and introduced in REVA University.

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to B Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B. Tech)	4 Years (8 Semesters)	A. FOR GENERAL MERIT CANDIDATES: A candidate who has Passed in 2nd PUC / 12 Std / Equivalent Examination with English as one of the Language and obtained a Minimum of 45% of Marks in aggregate in Physics and Mathematics as compulsory subjects along with Chemistry / Bio Technology / Biology / Computer Science / Electronics as optional subjects in the qualifying examination is eligible to pursue in under graduate programs (BE). B. FOR SC/ST & OBC (Cat-I, 2A, 2B, 3A 3B) CATEGORY CANDIDATES: A candidate who has Passed in 2nd PUC / 12 Std / Equivalent Examination with English as one of the Language and obtained a Minimum of 40% of Marks in aggregate in Physics and Mathematics as compulsory subjects along with Chemistry / Bio Technology / Biology / Computer Science / Electronics as optional subjects in the qualifying examination is eligible to pursue in under graduate pogroms (BE). C. The marks obtained by the candidate in Biotechnology/Biology/Computer Science / Electronics in the qualifying examination will be considered in the place of Chemistry in case the marks obtained in Chemistry is less for the required aggregate percentage for the pursue of determination of eligibility.

Sl. No.	Program	Duration	Eligibility
2	Bachelor of Technology (B Tech-Lateral Entry program)	3 Years (6 Semesters)	A. Candidate who has passed Qualifying Examination i.e. any diploma examination or equivalent examination and obtained an aggregate minimum of 45 % (for General Merit Candidates) of marks taken together in all the subjects of the final year (i.e.,fifth and six semesters) diploma examination (Q E) is eligible for admission to B E-Courses and 40% of marks in Q. E. in case of SC, ST and Backward Classes of Karnataka Candidates. Passed B.Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. B. Provided that in case of students belonging to B.Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects. C. Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream. D. Provided further that student, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above. E. Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the program)
3	Bachelor of Technology (B Tech)		Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the University requirements.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning, CIA and the remaining 4 weeks for SEE, evaluation and result declaration.

6.3 The credit hours defined as below:
In terms of credits, L refers to lecture hour (theory) credit per week, that indicate every one hour lecture per week of L amounts to 1 credit per Semester; T and P refer to tutorial hours and practice hours credit per week, that indicate every two hours of T and P per week amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits per semester.

The total duration of a semester is 20 weeks inclusive of semester-end examination.

The following table describes credit pattern

Table -2: Credit Pattern

Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total Contact Hours
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2
0	0	2	0:0:1	1	2

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course.

7. Different Courses of Study:

Different **Courses of Study** are labeled as follows:

a. Foundation Course (FC)

b. Professional Core Course (Hard Core(HC))

c. Professional Elective Course (Soft Core(SC))

d. Open Elective Course (OE)

e. Skill Development Course (SDC)

f. Audit Course (Non-credit Course/ Mandatory Course) (MC)

g. Project Work / Dissertation: A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated. These are defined under Section 4.2.6 of this regulation.

h. Emerging Technology Course(ETC)

8. Credits and Credit Distribution

A candidate must earn 160 credits for successful completion of B Tech degree with the distribution of credits for different courses with the credit distribution given in the scheme of study.

8.1 The concerned BOS based on the credits distribution shall prescribe the credits to various types of courses listed in section 4.2 and shall assign title to every course thereon.

8.2 Every course including project work, practical work, field work, self-study elective should be entitled as per the list declared in section 4.2. However, as per AICTE, the credit distribution for various category of courses is given below in the table.

Sl. No.	Course Category	Abbreviation (AICTE)	Suggested breakup of credits (AICTE)	Credit breakup (REVA)
1	Humanities and Social Sciences including Management courses (HSMC)	HSMC	12	9
2	Basic Science Courses	BSC	25	19
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	ESC	24	23
4	Program Core Courses	PCC	48	61
5	Program Elective courses relevant to chosen specialization/branch	PEC	18	18
6	Open subjects – Electives from other technical and /or emerging subjects	OE	18	6
7	Project work, seminar and internship in industry or elsewhere	PROJ	15	18
8	Audit Courses (Mandatory Course)	MC	-	-
9	Skill Development Courses (SDC)/ETC/AEC	ETC/AEC/SDC		6
			160	160

8.3 The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program. A candidate can enroll for a maximum of 26 credits and a minimum of 16 credits per Semester. However, he / she may not successfully earn a maximum of 26 credits per semester. This maximum of 26 credits does not include the credits of courses carried forward by a candidate.

8.4 Only such full-time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 160 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students.

8.5 Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree: a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B Tech Degree program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so issued to the candidate contains the courses studied and grades earned.

9 Assessment and Evaluation

9.1 The Scheme of Assessment will have two parts, namely;

i. Continuous Internal Assessment (CIA); and
ii. Semester End Examination (SEE)

9.2 Assessment and Evaluation of each Course shall be for 100 marks. The CIA and SEE of UG Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks CIA; 50 marks for SEE).

9.3 The 50 marks of CIA shall comprise of:

Internal Assessment Test (IA Test)	40 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes, etc.	10 marks

9.4 There shall be **two Internal Assessment Tests** (IA tests) are conducted as per the schedule announced below. **The Students shall attend both the Tests compulsorily.**

- 1st test is conducted for 20 marks during **8th week** of the Semester;
- 2nd test is conducted for 20 marks during **15th week** of the of the Semester;

9.5 The coverage of syllabus for the said tests shall be as under:

- The question paper of the **1st test should be based on first 50% of the total syllabus**.
- The question paper of the **2nd test should be based on remaining 50 % of the total syllabus.**
- An assignments must be designed to cover the entire syllabus.

9.6 There shall be two Assignments / Project Based Learning / Field Visit / Quiz test carrying 10 marks covering the entire syllabus.

9.7 SEE for 50 marks practical exam shall be held during 16th and 17th week of the semester.

9.8 SEE for 50 marks theory exam shall be held during 18th 19th and 20th week of the semester and it should cover entire syllabus.

9.9 IA test paper is set for a maximum of 40 marks to be answered in 1.5 hours duration (for 1 credit course, exam is conducted for 25 marks with a duration of 1 hour). A test paper can have 5 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totaling 10 marks. Students are required to answer any 4 main questions. Each question is set using Bloom's action verbs. The questions must be set to assess the course outcomes described in the course document with the choice is given in questions.

9.10 The question papers for IAs shall be set by the internal faculty who have taught the course. If the course is taught by more than one faculty all them together shall devise a common question paper(s). However, these question papers shall be scrutinized by the Question Paper Scrutiny Committee (internal BoE members) to bring the quality and uniformity in the question paper.

9.11 The evaluation of the answer scripts shall be done by the internal faculty who have taught the course and set the test paper. After evaluation of answer booklets faculty must distribute to students. If any corrections are noticed by students, faculty have to justify the award of marks. The final marks are to be declared only after such corrections. school/Department has to take signature for the marks obtained.

9.12 Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount of self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarize the answer any other resources. Course faculty at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and self-study.

9.13 CIA marks must be decided well before the commencement of SEE.

9.14 The SEE theory question paper is designed to comprehensively evaluate student's understanding and mastery of the course content. A total of 8 main questions will be crafted to cover the entire syllabus, out of which students are required to answer any 5 questions in full. Each main question will carry a maximum of 20 marks and may include 3 to 4 sub-questions. The maximum marks for each course is 100, and the duration is 3 hours. All questions must be formulated using Bloom's action verbs to ensure alignment with cognitive learning objectives. Additionally, the questions must be meticulously crafted to assess the student outcomes detailed in the course document, ensuring thorough coverage of all the course outcomes.

9.15 There shall be minimum three sets of question papers for the SEE, of which one set along with scheme and solution of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the question papers shall be scrutinized by the Board of Examiners (BoE). It shall be responsibility of the BOE particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

9.16 There shall be single evaluation by the examiners for each paper. However, there shall be moderation by one of the senior examiners, either internal or external.

9.17 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

9.18 There shall also be a **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School.

9.19 The report provided by the PAC shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program.

9.20 During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with Controller of Examination and Vice chancellor.

9.21 University may decide to use available modern technologies for writing the IAs and SEE by the students instead of traditional pen and paper.

9.22 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor.

9.23 Online courses may be offered as per UGC norms.
For online course assessment guidelines would be as follows:

a. If the assessment is done by the course provider, then the School can accept the marks awarded by the course provider and assign the grade as per REVA University norms.

b. If the assessment is not done by the course provider then the assessment is organized by the concerned school and the procedure explained in the regulation will apply.

c. In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits.

IAs for online courses could be avoided and will remain at the discretion of the School.

9.24 The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

9.25 Mapping of one or two credit online courses would be:

4 week online course – 1 credit

8 week online course / MOOC – 2 credits

12 week online course / MOOC – 3 credits

9.26 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below (for theory courses having Credits >=2).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Scaled down to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	40	20	9th week
2	Test -2	During 15th Week	Remaining 50%	40	20	16th Week
3	Assignment 1/ Quiz - 1	Every week till Test-1	First 50%	10	05	9th Week
4	Assignment 2 / Quiz - 2	Every week during Test-1 and Test-2	Remaining 50%	10	05	16th Week
5	SEE	18th to 20th Week	100%	100	50	20th Week

9.27 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below (for theory courses having Credit 1).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	25	12.5	8th week
2	Test -2	During 15th Week	Remaining 50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

10 Assessment of Students Performance in Practical Courses

Lab courses are of two types: integrated labs and separate labs.

The performance in the practice tasks / experiments shall be assessed on the basis of:

a. Knowledge of relevant processes;
b. Skills and operations involved;
c. Results / products including calculation and reporting

10.1 Assessment of lab courses

10.1.1 Assessment of Separate lab course

The 50 marks of CIA is based on the performance of students in each lab experiment for a lab course that shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester(Continuous evaluation)	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	20 marks
	Total	**50 marks**

10.2 Assessment of integrated lab course

The 10 marks meant for CIA is based on the performance of students in each lab experiment for integrated lab course that shall further be allocated as under.

Integrated lab is evaluated and awarded marks should meet the requirement of assignment/quiz/field work component of respective theory course having integrated lab component. No separate assignment/quiz/filed work is assessed for such courses.

i	Conduction of regular practical / experiments throughout the semester (continuous evaluation)	05 marks
ii	Maintenance of lab records and performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	05 marks
	Total	**10 marks**

10.3 The 50 marks meant for SEE in case of separate lab course shall be allocated as under:

i	Conduction of practical (experiment)	30 marks
ii	Write up about the experiment/tabulation/results/inference	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

Note: No Separate SEE for integrated lab course

10.4 The duration for semester-end practical examination shall be decided by the concerned School Board.

10.5 For MOOC and Online Courses assessment shall be decided by the BOS of the School.

For >= 2 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
	Total	**100 marks**

For 1 credit courses

i	IA (Performance of internal test to be conducted after completion of entire syllabus)	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	25 marks
	Total	**50 marks**

11. Evaluation of Minor Project / Major Project / Dissertation >4 credit:

Right from the initial stage of defining the problem, the candidate must submit the progress reports periodically and present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate must submit final report of the project / dissertation for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

i	Phase-1 presentation	50 marks
ii	Phase-II presentation	50 marks
III	SEE	100 marks
	Total	**200 marks**

12. Evaluation of mandatory courses: Students should maintain minimum of 75% attendance to appear for SEE of Mandatory course. The SEE should be conducted in MCQ pattern and students should get minimum pass grade to obtain the degree. There is no internal assessment.

13. Evaluation of **Skill Development Courses:** The concerned BoS shall recommend to conduct test/demo/viva-voce/MCQ to test the student knowledge.

14. Requirements to Pass a Course:

A candidate's performance from CIA and SEE will be in terms of scores, and the sum of CIA and SEE scores will be for a maximum of 100 marks (CIA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate must secure a minimum of 30% (15 marks) out of 50 marks in SEE, which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the subject will be as given below:

SGPA/CGPA	Grade Point	Letter Grade	Performance	FGP
				Qualitative Index
9>=CGPA<=10	10	O	Outstanding	First Class with Distinction
8>=CGPA<=9	9	A+	Excellent	
7>=CGPA<=8	8	A	Very Good	First Class
6>=CGPA<=7	7	B+	Good	
5.5>=CGPA<=6	6	B	Above Average	Second Class
5>=CGPA<=5.5	5.5	C+	Average	
4>=CGPA<=5	5	C	Satisfactory	Pass
<4CGPA	0	F	Not Satisfactory	Unsuccessful

a. Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) = ∑(Ci x Gi) / ∑Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
Course 7	3	O	10	3X10=30
	19			159

Thus, **SGPA = 159 ÷ 19 = 8.37**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
Course 7	2	B+	7	2X7=21
Course 8	2	O	10	2X10=20
	24			182

Thus, SGPA = 182 ÷ 24 = 7.58

Illustration No.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (168) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : **CGPA = ∑(Ci x Si) / ∑Ci**

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	21	6.83	21 x 6.83 = 143.43
2	20	7.29	20 x 7.29 = 145.8
3	25	8.11	25 x 8.11 = 202.75
4	25	7.40	25 x 7.40 = 185
5	22	8.29	22 x 8.29 = 182.38
6	23	8.58	23 x 8.58 = 197.34
7	14	9.12	14 x 9.12 = 127.68
8	10	9.25	10 x 9.25 =92.50
Cumulative	**160**		**1276.88**

Thus,

$$\boldsymbol{CGPA} = \frac{\mathbf{1276.88}}{\mathbf{160}} = 7.98$$

c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.02 x 10=80.2

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

e. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA).**

f. **Final Grade Card:** Upon successful completion of B Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

14.2 Attendance Requirement

14.2.1. All students must attend every lecture, tutorial and practical classes.

14.2.2. Student must maintain a minimum attendance of 75% in each course (Theory and Practical) and 75% attendance in aggregate of all courses in a semester, with a provision of condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the Director of the School.

14.2.3. In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 65% of the classes taught.

14.2.4. Any student with less than 75% of attendance in individual courses of respective semester including practical courses / field visits etc., shall not be permitted to appear to SEE in the respective course.

15. Re-Registration and Re-Admission

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

16. Absence during Internal Test:

In case a student has been absent from an internal test due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

17.1 Grievance Committee:

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances.

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

i. The Controller of Examinations - Ex-officio Chairman / Convener

ii. One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.

iii. One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

18. Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., and 70% attendance in each courses shall be eligible to appear for Semester End Examination

19. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 30% marks out of 50 (15 marks) in Semester End Examination (SEE) and a minimum of 40% marks (out of 100) together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even/Odd semester examination results. The candidate who is unsuccessful in each course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

a. A student failed in any course is eligible to take supplementary exam under following category for each course: either to improve internal marks (IA1, IA2, and Assignment/Quiz), or to improve SEE.

b. Supplementary exam is permitted only during summer vacation (between even and odd semester break)

c. Eligibility to register for supplementary exam is that the student should have maintained pre-requisite attendance of ≥ 75% in respective semester.

d. No separate additional classes would be conducted for the students availing this facility.

e. Every student should pay the supplementary exam fee for each course as prescribed by the university.

20. Provision to Carry Forward the Failed Subjects / Courses:

Students who have failed in courses totalling 16 credits or fewer across both odd and even semesters combined will be allowed to proceed to the next semester of the following year(s) of their academic program.

For vertical progression, students must clear all the courses of first year to be eligible to take admission to third year and they have to clear all the courses till second year to be eligible to take admission to fourth year. For lateral entry students, students must clear all the courses of second year to be eligible to take admission to fourth year.

Case 1: A student who has failed in a maximum of 16 credits in 1st and 2nd semester together shall move to the 3rd semester of the succeeding year.

Case 2: A student who has failed in a maximum of 16 credits from semester 1 to 4 together shall move to the 5th semester of the succeeding year only if he/she successfully completes all the courses of first and second semester.

Case 3: A students who has failed in a maximum of 16 credits from semester 3 to 6 together shall move to the 7th semester of the succeeding year only if he/she successfully completes all the courses of third and Fourth semester.

21. Re-evaluation of Answer Scripts and Announcement of Re-evaluation Results

After declaration of the results of programs within next 10 days, if any candidate wishes to apply for Photocopy/Revaluation (only theory courses), s/he shall apply to the Controller of Examinations, by paying the prescribed fees notified by the University from time to time. The photocopies of the said answer books shall be made available within next TEN working days after the last date prescribed for receipt of the application at the Office of the Controller of Examinations. Photocopies will not be issued for practical/drawing/audit courses.

22. Results of Re-Evaluation will be announced within TWENTY working days (except for third evaluation).

23. Regarding any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

24. All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

25. For lateral entry students, the minimum credits to be earned for the award of the degree would be the credits earned in 3 years from 2nd year to 4th year.

ABOUT THE SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

The school has a rich blend of experienced and committed faculty who are well qualified in various aspects of Computer Science and Engineering apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The school offers B.Tech. in Computer Science and Engineering, B.Tech in Artificial Intelligence and Data Science, B. Tech in Computer Science and Engineering (Internet of Things and Cyber Security including Block Chain Technology), M.Tech in Computer Science and Engineering (Full Time) and M.Tech in Computer Science and Engineering (Part-Time).

In addition, the school has a unique academic collaboration with the University of Alabama in Huntsville to jointly offer an MS program in Computer Science. In addition, the department has a research center in which students can conduct cutting edge research leading to a Ph.D degree.

Curricula of both undergraduate and postgraduate programs have been designed through a collaboration of academic and industry experts in order to bridge the growing gap between industry and academia. This makes the program highly practical-oriented, and thus industry-resilient. The B.Tech program aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world.

The master's degree focus on quality research and design in the core and application areas of computing to foster a sustainable world and to enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters' programs.

Vision

Department of Computer Science and Engineering aspires to create a pool of high-calibre technologists and researchers in the field of computer science and engineering who have potential to contribute for development of the nation and society with their expertise, skills, innovative problem-solving abilities and strong ethical values.

Mission

MD1: To create center of excellence where new ideas flourish and from which emerge tomorrow's researchers, scholars, leaders, and innovators.

MD2: Provide quality education in both theoretical and applied foundations of computer science and engineering, related inter-disciplinary areas and train students to effectively apply the knowledge to solve real-world problems.

MD3: Amplify student's potential for life-long high-quality careers and make them competitive in ever-changing and challenging global work environment.
MD4: Forge research and academic collaboration with industries and top global universities in order to provide students with greater opportunities.

MD5: Support the society by encouraging and participating in technology transfer.

Quality Policy

The School of Computer Science and Engineering is committed to excellence through following policies.

1. Impart quality education by providing state of art curriculum, experimental learning, and state- of-the-art labs.

2. Enhance skill set of faculty members through faculty development programs and interactionwith academia and industries.

3. Inculcate competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exihibition, Internship and Entrepreneurship Programmes.

4. Provide soft skill and skill development training for personality development and better placement.

5. Promote innovation and research culture among students and support faculty members for better research and development activity

ADVISORY BOARD

S. No	Name	Internal / External Member	Affiliation
1.	Dr. N P Nethravathi HOD IOT, Professor, School of CSE, REVA University	Internal Member	REVA University
2.	Dr. Argha Sarkar Associate Professor, School of CSE, REVA University	Internal Member	REVA University
3.	Dr. Bhargavi Latha Associate Professor, School of CSE, REVA University	Internal Member	REVA University
4.	Dr. T Y Satheesha Associate Professor, School of CSE, REVA University	Internal Member	REVA University
5.	Dr. Raghavendra Reddy Associate Professor, School of CSE, REVA University	Internal Member	REVA University
Invited Members-Internal			
6	Dr. R C Biradar Pro Vice-Chancellor Department of Administration REVA University	Invited Member	
7	Dr. Sarvamangala Professor School of Computing and Information Technology REVA University	Invited Member	
Representation from Career Development Center (CDC)			
8	Mr. Naveen C	Invited member	

	Senior Manager-training and palcement Career Development Centre REVA University	
9	Mr. Samuel A Manager- Corporate relations Career Development Centre REVA University	Invited member
Representation from Office of COE		
10	Mr. Ananda Raju Special Officer, Dept. of Evaluation REVA University	Invited member
11	Mr. Prasanna Kumara R.B Asst. COE Dept. of Evaluation REVA University	Invited member
Representation from UIIC		
12	Dr. Kiran Kumari Patil Dean-UIIC REVA University	Invited member
Domain Experts / Subject Experts		
13	Dr. Nagaraja G S Professor and Associate Dean, Dept. of CSE, R V College of Engineering, Bengaluru nagarajags@rvce.edu.in 9880017459	External
14	Dr Indiramma M HoD AI&ML BMS college of Engineering hod.ads@bmsce.ac.in 9663376002	External
Industry Experts / Recruiters		
15	Mr. Praksah S G Technical Lead, Infosys, Bengaluru 9663654326, prakash.naik@infosys.com	External
16	Dr. Surendra H Senior Manager, ML Engineering Accenture, Bengaluru Surendra.h@gmail.com 96112 77995	External
Member from IQAC		
17	Dr. Purba Prasad Borah Deputy Director-IQAC REVA University	Internal Member
Member from International Relations		
18	Dr. P Visweswara Rao Associate Dean, International Research and Relations Collaborations REVA University	Internal Member

Alumni Student Representative		
19	Ms. Pooja Karnik Jagadish Senior Software Engineer, Accenture 7022146376 poojakamik195@gmail.com	Alumni Member
20	Mr. Deepak R Software Engineer, Atlam, Deepakcoder98@gmail.com 9740720910	Alumni Member
Student Representative		
21	Chitranjan S(R22EI033) 3rd Semester	II Year
22	Pranjali Desai (R23EI031) 3rd Semester	II Year

Program Educational Objectives (PEOs)

The program helps to develop critical, analytical, innovative, creative and problem-solving abilities amongst its graduates. The programme makes the graduates employable as Software Engineers across sectors. With further education and earning of higher-level degrees help the graduates to pursue a career in academics or scientific organisations as researchers.

The Program Educational Objectives (PEOs):
After few years of graduation, the graduates of B. Tech. Computer Science and Engineering(Internet of Things and Cyber Security including Block Chain Technology) will:

- **PEO-1:** Have a successful professional career in industry, government, academia and defence as an innovative engineer in a team.
- **PEO-2:** Develop code and solutions to industry and societal needs in a rapid changing technological environment and communicate with clients as an entrepreneur.
- **PEO-3:** Pursue higher studies and continue to learn by participating in conferences, seminars, etc.

Program Outcomes (POs)

On successful completion of the program, the graduates of B. Tech. Computer Science and Engineering (Internet of Things and Cyber Security including Block Chain Technology) program will be able to:

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering using IoT, Cybersecurity and Blockchain technologies.

PO-2: Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: 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.

PO-7: 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.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and teamwork: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12: 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.

Programme Specific Outcomes (PSOs)

On successful completion of the program, the graduates of B. Tech. Computer Science and Engineering (Internet of Things and Cyber Security including Block Chain Technology) program will be able to:

PSO-1: Demonstrate the knowledge of Data structures and Algorithms, Operating Systems, Embedded Systems, Artificial Intelligence and Machine Learning, Internet of Things, Cyber Security, Blockchain and Networking for efficient design of intelligent systems.

PSO-2: Use of modern tools and techniques in the areas of the Internet of Things, Cyber Security and Blockchain technologies.

PSO-3: Pursue advanced skills and research to innovate novel tools and systems for societal needs.

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

HANDBOOK

B. Tech. Computer Science and Engineering (IoT & Cyber Security including Block Chain Technology))

2024-28

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-66226622, Fax: 080-28478539

Rukmini Educational
Charitable Trust

www.reva.edu.in

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS (2024 – 2028 BATCH)

I Semester (Physics Cycle)

I Semester (Chemistry Cycle)												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24AS0103	Multivariable Calculus and Linear Algebra	FC	3	0	0	3	3	50	50	100	BSC
2	B24AS0105	Chemical Technology for computing	FC	2	1	0	3	4	50	50	100	BSC
3	B24EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	0	3	3	50	50	100	ESC
4	B24CS0104	Fundamentals of Data Science	HC	2	0	0	2	2	50	50	100	ESC
5	B24CI0109	Fundamentals of C programming	HC	1	1	0	2	3	50	50	100	ESC
6	B24ED0102	Fundamentals and Applications of Civil Engineering	HC	1	1	0	2	3	50	50	100	ESC
7	B24CS0108	Fundamentals of Data Science lab	HC	0	0	1	1	2	25	25	50	ESC
8	B24EE0102	Basics of Electrical and Electronics lab	HC	0	0	1	1	2	25	25	50	ESC
9	B24ME0101	Computer Aided Engineering Drawing	HC	1	0	1	2	3	50	50	100	ESC
10	B24CI0110	Fundamentals of C programming lab	HC	0	0	1	1	2	25	25	50	ESC
11	B24EN0102	Finance and Management	FC	1	0	0	1	1	25	25	50	HSMC
12	B24CS0109	Foundation for Learning	MC	0	0	0	0	1	25	25	50	
TOTAL				**15**	**2**	**4**	**21**	**29**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS					**21**							
TOTAL CUMULATIVE CREDITS					**21**							
TOTAL CONTACT HOURS					**28**							
TOTAL MARKS					**950**							

II Semester (Chemistry Cycle)

II Semester **(Physics Cycle)**													
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/SC/OE/MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24AS0203	Probability and Statistics	FC	3	0	0	3	3	50	50	100	BSC
2	B24AS0106	Physics for Computer Science	FC	3	0	0	3	3	50	50	100	BSC
3	B24ME0105	Fundamentals of Mechanical Engineering	HC	3	0	0	3	3	50	50	100	ESC
4	B24CI0201	Advanced C programming and Applications	HC	1	1	0	2	3	50	50	100	ESC
5	B24EN0101	Internet of Things	HC	1	0	1	2	3	50	50	100	ESC
6	B24AS0208	Physics for Computer Science Lab	FC	0	0	1	1	2	25	25	50	ESC
7	B24CI0202	Advanced C programming and Applications Lab	HC	0	0	1	1	2	25	25	50	ESC
8	B24ME0102	Innovation & Entrepreneurship	FC	1	0	1	2	3	50	50	100	HSMC
9	B24AH0103	Communicative English	FC	0	0	1	1	2	25	25	50	HSMC
10	B24CIET01	Engineering Exploration	ETC	1	0	0	1	1	25	25	50	HSMC
11	B24CSET02	Emerging Technologies on Full Stack Web Development	ETC	1	0	0	1	1	25	25	50	ETC
TOTAL				**14**	**1**	**5**	**20**	**26**	**425**	**425**	**850**	
TOTAL SEMESTER CREDITS					**20**							
TOTAL CUMULATIVE CREDITS					**41**							
TOTAL CONTACT HOURS					**26**							
TOTAL MARKS					**850**							

III SEMESTER

III Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24	Discrete Mathematics and Graph Theory	FC	3	0	0	3	3	50	50	100	BSC
2	B24EF0301	Data Structures	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0301	Object Oriented Programming with Java	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0302	Digital Logic and Design	HC	3	0	0	3	3	50	50	100	PCC
5	B24EIS31X	Professional –Elective-1	SC	3	0	0	3	3	50	50	100	PEC
6	B24EF0304	Data Structures Lab Using C	HC	0	0	1	1	2	25	25	50	PCC
7	B24EI0303	Object Oriented Programming with Java Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0304	Digital Logic and Design Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0305	Course based Project (SDC)	SDC	0	0	1	1	2	25	25	50	Proj
10	B24CI0309	Introduction to Design Thinking	HC	1	0	1	2	3	50	50	100	ESC
11	B24	Technical Documentation	FC	1	0	0	1	1	25	25	50	HSMC
12	B24	Indian Constitution and cyber law	MC	1	0	0	0	1				HSMC
13	B24EF0308	AEC-1(Ability Enhancement Course) (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				**18**	**0**	**6**	**23**	**30**	**450**	**450**	**900**	
TOTAL SEMESTER CREDITS					**23**							
TOTAL CUMULATIVE CREDITS					**64**							
TOTAL CONTACT HOURS					**30**							
TOTAL MARKS					**900**							

IV SEMESTER

IV Semester												
Sl. No	Course Code	Title of the Course	HC/FC/ SC/OE /MC	Credit Pattern				Contact Hours/ Week	Examination			AICTE Course category
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B24EH0401	Optimization Techniques	FC	3	0	0	3	3	50	50	100	BSC
2	B24EF0401	Design and Analysis of Algorithms	HC	3	0	0	3	3	50	50	100	PCC
3	B24EF0402	Computer Organization and Architecture	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0401	Database Management Systems	HC	3	0	0	3	3	50	50	100	PCC
5	B24EI0402	Embedded Systems for IoT	HC	3	0	0	3	3	50	50	100	PCC
6	B24EIS41X	Professional Elective-2	SC	3	0	0	3	3	50	50	100	PEC
7	B24EF0405	Design and Analysis of Algorithms Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EF0406	Microcontroller and IOT Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0403	Database Management Systems Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EI0404	Course based Project	SDC	0	0	1	1	2	25	25	50	Proj
11	B24-	Professional Ethics	FC	1	0	0	1	1	25	25	50	HSMC
12	B24-	Universal Human Values	HC	1	0	0	1	1	25	25	50	HSMC
13	B24-	Environmental Science	MC	1	0	0	0	1				HSMC
14	B24EF0409	AEC-2 (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				**21**	**0**	**5**	**25**	**31**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS					**25**							
TOTAL CUMULATIVE CREDITS					**89**							
TOTAL CONTACT HOURS					**31**							
TOTAL MARKS					**950**							

V SEMESTER

V Semester												
Sl. No	Course Code	Title of the Course	HC/FC/ SC/OE /MC	Credit Pattern				Contact Hours/ Week	Examination			AICTE Course category
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B24EF0501	Computer Networks	HC	3	0	0	3	3	50	50	100	PCC
2	B24EI0501	IoT Systems Processors	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0502	Web Technology	HC	3	0	0	3	3	50	50	100	PCC
4	B24EIS51X	Professional Elective-3	SC	3	0	0	3	3	50	50	100	PEC
5	B24EIS52X	Professional Elective-4	SC	3	0	0	3	3	50	50	100	PEC
6	B24EFO51X	Open Elective-1	OE	3	0	0	3	3	50	50	100	OE
7	B24EF0504	Computer Networks Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0503	IoT System Processors Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0504	Web Technology Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EF0507	AEC-3 (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
11	B24-	Indian Knowledge System	MC	1	0	0	0	1	25	25	50	HSMC
TOTAL				**19**	**0**	**4**	**22**	**27**	**425**	**425**	**850**	

TOTAL SEMESTER CREDITS	**22**
TOTAL CUMULATIVE CREDITS	**111**
TOTAL CONTACT HOURS	**27**
TOTAL MARKS	**850**

VI SEMESTER

VI Semester												
Sl. No	Course Code	Title of the Course	HC/FC/ SC/OE /MC	Credit Pattern				Contact Hours/ Week	Examination			AICTE Course category
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B24EF0601	Cryptography and Network Security	HC	3	0	0	3	3	50	50	100	PCC
2	B24EF0602	Agile Software Development and DevOps	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0601	Block Chain Technology	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0602	Machine Learning and Applications	HC	3	0	0	3	3	50	50	100	PCC
5	B24EIS61X	Professional Elective-5	SC	3	0	0	3	3	50	50	100	PEC
6	B24EFO61X	Open Elective-2	OE	3	0	0	3	3	50	50	100	OE
7	B24EF0605	Cryptography and Network Security Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0603	Block Chain Technology Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0604	Machine Learning and Applications Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EI0605	Mini Project	HC	0	0	2	2	4	50	50	100	Proj
11	B24EI0606	AEC-4 (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				**18**	**0**	**6**	**24**	**30**	**450**	**450**	**900**	
TOTAL SEMESTER CREDITS					**24**							
TOTAL CUMULATIVE CREDITS					**135**							
TOTAL CONTACT HOURS					**30**							
TOTAL MARKS					**900**							

VII SEMESTER

VII Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EI0701	Cyber Forensics and Investigation	HC	3	0	0	3	3	50	50	100	PCC
2	B24EIS71X	Professional Elective-6	SC	3	0	0	3	3	50	50	100	PEC
3	B24EI0702	Capstone Project Phase-1	HC	0	0	2	2	4	50	50	100	Proj
4	B24EI0703	Internship/Global Certification	HC	0	0	2	2	4	50	50	100	Intern
TOTAL				**6**	**0**	**4**	**10**	**14**	**200**	**200**	**400**	
TOTAL SEMESTER CREDITS					**10**							
TOTAL CUMULATIVE CREDITS					**145**							
TOTAL CONTACT HOURS					**14**							
TOTAL MARKS					**400**							

VIII SEMESTER

VII Semester												
Sl. No	Course Code	Title of the Course	HC/FC/ SC/OE /MC	Credit Pattern				Contact Hours/ Week	Examination			AICTE Course category
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B24EI0701	Cyber Forensics and Investigation	HC	3	0	0	3	3	50	50	100	PCC
2	B24EIS71X	Professional Elective-6	SC	3	0	0	3	3	50	50	100	PEC
3	B24EI0702	Capstone Project Phase-1	HC	0	0	2	2	4	50	50	100	Proj
4	B24EI0703	Internship/Global Certification	HC	0	0	2	2	4	50	50	100	Intern
TOTAL				**6**	**0**	**4**	**10**	**14**	**200**	**200**	**400**	
TOTAL SEMESTER CREDITS					**10**							
TOTAL CUMULATIVE CREDITS					**145**							
TOTAL CONTACT HOURS					**14**							
TOTAL MARKS					**400**							

Sem	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Credit	21	20	23	25	22	24	10	15	160

List of Professional Electives:

IoT	Course Code	T1 IoT	Course Code	T2 Cyber Security and Block Chain	Course Code	T3 AI and ML	Course code	T4 Hardware Design
III (PE1)	**B24EIS311**	Operating Systems	**B24EIS312**	Information and coding theory	**B24EIS313**	Foundation to AI	**B24EIS314**	Introduction to Verilog
IV (PE2)	**B24EIS411**	Micro Controllers	**B24EIS412**	Foundation of Cyber security	**B24EIS413**	Python Programming	**B24EIS414**	Introduction to FPGA Design
V(PE3)	**B24EIS511**	Theory of Computation	**B24EIS512**	Steganography and Digital Watermarking	**B24EIS513**	Natural Language Processing	**B24EIS514**	Basic VLSI Design
V(PE4)	**B24EIS521**	Sensors Actuators for IoT interfacing	**B24EIS522**	Cyber law and Digital Forensics	**B24EIS523**	Big Data Analytics	**B24EIS524**	System on Chip Design
VI(PE5)	**B24EIS611**	IoT Architecture and Protocols	**B24EIS612**	Cyber Security Assessment and Risk Analysis	**B24EIS613**	Edge Computing	**B24EIS614**	Multi Core Architecture and Programming
VII(PE6)	**B24EIS711**	Industrial IoT	**B24EIS712**	Blockchain Tools and Applications	**B24EIS713**	Data Mining and Data Ware Housing	**B24EIS714**	

List of Open Electives:

SEM	Course Code	Course Title & Code	Course Code	Course Title & Code
V (OE1)	**B24EFO511**	Data Science with Python	**B24EFO512**	Database management system
VI (OE2)	**B24EFO611**	Augmented Reality and Virtual Reality	**B24EFO612**	Data Communications and Systems

Nomenclature: **L:** Lecture, **T:** Tutorial, **P:** Practical/Practice/Hands-on, **HC**: Hard Core, **SC**: Soft Core, **FC**: Foundation Core, **OE**: Open Elective, **SDC:** Skill Development Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination, **BSC**: Basic Science Course, **HSMC**: Humanities, Social science and Management Course, **ESC**: Engineering Science Course, **PCC**: Program Core Course, **PEC**: Professional Elective Course, **MC**: Mandatory Course, **PROJ**: Project work/Internship

Note: SDC-1 will be hands-on based skill enhancement course that create expertise in the domain of respective engineering

BATCH 2024-28		AICTE	
Course Type	**Credit**	**Course Type**	**Credit**
BSC	18	BSC	25
ESC	25	ESC	24
HSMC	7	HSMC	12
PCC	60	PCC	48
PEC	18	PEC	18
OE	6	OE	18
Project, Internship	20	Project, Internship	15
ETC & AEC	5	**TOTAL**	160
FC	1		
TOTAL	160		

BATCH 2024-28									
Course Type	**Credit**								
Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**TOTAL**
BSC	6	6	3	3					18
ESC	14	9	2						25
HSMC	1	3	1	2					7
PCC			12	15	12	15	3	3	60
PEC			3	3	6	3	3		18
OE					3	3			6
Project, Internship			1	1		2	4	12	20
ETC & AEC	0	1	1	1	1	1			5
FC		1							1
TOTAL									160

Common Courses for AY 2024-28

S. no	Semester	COURSE CODE	COURSE NAME	HC/FC/SC/OE/MC	L	T	P	TOTAL CREDITS	CONTACT HOURS	AICTE course category
1	I	B24EN0102	Finance and management	FC	1	0	0	1	1	HSMC
2	II	B24ME0102	Innovation and Entrepreneurship	FC	1	0	1	2	3	HSMC
3		B24AH0103	Communicative English	FC	0	0	1	1	2	HSMC
4	III		Introduction to Design Thinking	HC	1	0	1	2	3	ESC
5			Technical Documentation	FC	1	0	0	1	1	HSMC
6			Indian Constitution and Cyber law	MC	1	0	0	0	1	HSMC
7	IV		Professional Ethics	FC	1	0	0	1	1	HSMC
8			Universal Human Values	HC	1	0	0	1	1	HSMC
9			Environmental Science	MC	1	0	0	0	1	HSMC
10	V	B24ED0501	Indian Knowledge Systems	MC	1	0	0	0	1	HSMC

I Semester (Physics Cycle)

I Semester (Chemistry Cycle)													
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24AS0103	Multivariable Calculus and Linear Algebra	FC	3	0	0	3	3	50	50	100	BSC
2	B24AS0105	Chemical Technology for computing	FC	2	1	0	3	4	50	50	100	BSC
3	B24EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	0	3	3	50	50	100	ESC
4	B24CS0104	Fundamentals of Data Science	HC	2	0	0	2	2	50	50	100	ESC
5	B24CI0109	Fundamentals of C programming	HC	1	1	0	2	3	50	50	100	ESC
6	B24ED0102	Fundamentals and Applications of Civil Engineering	HC	1	1	0	2	3	50	50	100	ESC
7	B24CS0108	Fundamentals of Data Science lab	HC	0	0	1	1	2	25	25	50	ESC
8	B24EE0102	Basics of Electrical and Electronics lab	HC	0	0	1	1	2	25	25	50	ESC
9	B24ME0101	Computer Aided Engineering Drawing	HC	1	0	1	2	3	50	50	100	ESC
10	B24CI0110	Fundamentals of C programming lab	HC	0	0	1	1	2	25	25	50	ESC
11	B24EN0102	Finance and Management	FC	1	0	0	1	1	25	25	50	HSMC
12	B24CS0109	Foundation for Learning	MC	0	0	0	0	1	25	25	50	
TOTAL				**15**	**2**	**4**	**21**	**29**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS					**21**							
TOTAL CUMULATIVE CREDITS					**21**							
TOTAL CONTACT HOURS					**28**							
TOTAL MARKS					**950**							

Course Title	**Multivariable Calculus and Linear Algebra**				**Course Type**		**FC**	
Course	**B24AS0103**	**Credits**	**3**		**Class**		**I Semester**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture	3	3	3				
	Tutorial	-	0	0	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

The course Differential Calculus deals with the basic aspects differential calculus. The students of Computer Science are equally benefited with this course as stepping stone to the broad areas of calculus. This course familiarize students with important concepts coming under differential calculus and to develop strong foundations on these concepts. In Computer Science, Calculus is used for machine learning, data mining, scientific computing, image processing, and creating the graphics and 3D visuals for simulations. Calculus is also used in a wide array software program that require it. Linear algebra provides concepts that are crucial to many areas of computer science, including graphics, image processing, cryptography, machine learning, optimization, graph algorithms, information retrieval and web search.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Explain the scalar and vector point functions and their operations.
2. Illustrate how to find angle between polar curves with a suitable example.
3. Demonstrate the use of radius of curvature of the curves can be best suited for machine learning techniques with big data analytics.
4. Describe the concepts of Linear algebra and calculus theory.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO-1	Apply knowledge of divergence, curl, and scalar potential in the vector field	1,2,4	1
CO-2	Apply Taylor's and Maclaurin's series for finding series expansions of the functions and approximating values	1,2,4	1
CO-3	Evaluate the limit using L' Hospital rule after identifying an indeterminate form.	1,2,4	1
CO-4	Solve the given system of equations by Gauss elimination and the Gauss Jordon method for the consistent equations.	1,2,4	1
CO-5	ermine the Eigen values, the corresponding Eigen vectors and diagonalize the given square matrix.	1,2,4	1
CO-6	Apply Rayleigh's Power method to find the largest Eigen value and the corresponding Eigen vector.	1,2,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO-1			√			
CO-2			√			
CO-3					√	
CO-4			√			
CO-5					√	
CO-6			√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3		1									1		
CO-2	3	3		2									1		
CO-3	3	2		1									1		
CO-4	3	3		1									1		
CO-5	3	3		1									1		
CO-6	3	2		1									1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Vector Calculus: Velocity, Acceleration, Tangent and normal vectors, Gradient, Divergence, Curl, Solenoidal and Irrotational vectors, Scalar potential, Vector identities (Basic identities)**.** *Case study on perception learning in neural networks. ** Applications: vector theory for data transmission, social network analysis*.

Differential Calculus: nth derivatives of standard function (without proof, *simple problems), Leibnitz theorem (without proof)-simple problems, Taylors series and McLaurin's series expansion for a function of one variable (only problems), Indeterminate forms 'solve using L- Hospital's rule. *Case study on image segmentation using edge detection. ** Applications: creating graphs or visuals, simulations, coding in applications, creating statistic solvers.*

LinearAlgebra-1: Echelon form, Normal form of a matrix, Rank of Matrix, Gauss-Jordon method to find the inverse of a matrix, Gauss elimination, and Gauss-Jordon method to solve the system of equations. Linear Algebra for statistics. *Case study on regression analysis. ** Application: Image processing, computer graphics, encryption, and decryption of the codes.*

Linear Algebra-2: Linear transformation, Eigen values, and Eigen Vectors up to 3*3 matrices, Diagonalization for 2*2 matrices, Rayleigh power method to determine largest Eigen value and the corresponding Eigen vector, Complex matrices. *Case study on dimensionality reduction using PCA. ** Application: Matrix operation in Machine Learning, Face*

*** Application: (i) Additional information providing to students only for knowledge.*
(ii) Major part of assignments questions chosen from applications.
(iii) Students' presentations/seminars topics chosen from applications.

TEXT BOOKS:

1. Theodore Shifrin, “Multi-Variable Calculus and Linear Algebra with Applications”, Wiley, 1st edition, Volume 2, 2018.
2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 43nd edition, 2015.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley Publications, 9th edition,2013.
4. Ron Larson, “Multivariable Calculus, Cengage Learning”, 10th Edition, 2013.

REFERENCE BOOKS:

1. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Publications, 19th Reprint edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing House, 4th edition, 2016.
3. Stanley I. Grossman, “Multivariable Calculus, Linear Algebra, and Differential Equations”, 2nd edition, Academic Press 1986.

JOURNALS/MAGAZINE:

https://www.sciencedirect.com/journal/linear-algebra-and-its-applications

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/107/111107108/
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ma07/
3. https://nptel.ac.in/courses/111/106/111106051/
4. https://nptel.ac.in/courses/111/104/111104092/
5. https://nptel.ac.in/courses/111/104/111104085/

SELF-LEARNING EXERCISES:

Vector spaces, Curvilinear co-ordinates: Cylindrical and spherical co-ordinates

Course title	**Chemical Technology for Computing**				**Course type**		**FC**	
Course code	**B24AS0105**	**Credit**	**3**		**Class**		**I semester**	
	LTP	**Credit**	**Contact Hours**	**Workload**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**2**	**2**	**2**				
	Tutorial	**1**	**2**	**2**	**Theory**	**Practical/tutorial**	**CIE**	**SEE**
	Practical	**-**		**-**	**28**	**28**	**50**	**50**
	Total	**3**	**4**	**4**				

COURSE OVERVIEW:

Engineering chemistry integrates highly pertinent subjects that are suitable for engineering students enlightening them about the significance of several facets of fundamental science in engineering. Engineering chemistry includes the study of instrumental technology analysis methods, technologies for clean and green energy storage and conversion devices, and novel materials for electronic devices. Additionally, the course emphasizes the study of the chemical properties and uses of functional materials in several engineering fields. This field of science is highly interdisciplinary and provides an opportunity for students to enhance their understanding of engineering principles concerning sustainable energy, conversion, and storage devices, semiconducting materials, and polymeric materials. These areas have become especially interesting for engineering research. The topic encompasses a wide range of engineering materials, their characteristics, and their use in the engineering domain.

COURSE OBJECTIVES:

The objectives of the course are to:

1. Understand the electronic transitions in materials, instrumental methods of analysis in technology using various instruments.
2. Illustrate renewable energy storage and conversion device technologies for batteries, super capacitors of operating mechanisms and applications.
3. Acquire a comprehensive understanding of advanced materials used in electronic devices, with a specific emphasis on the significance of semiconducting materials and the principles of metal finishing in industrial procedures.
4. Identify efficient polymeric materials, liquid crystals in display technologies and electronic applications.

COURSE OUTCOMES (COs):

After successful completion of this course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Interpret the instrumental methods of analysis in technology, electronic transitions in materials and the detection of samples using various sensors.	1,2,3,5	1
CO2	Demonstrate the principles and uses of clean-green energy storage and conversion device technologies.	1,2,3,5,7	1
CO3	Identify the significance of modern materials in electronic devices and the theory of electroplating in industrial techniques.	1,2,3,5,7	1
CO4	Analyze the importance of polymeric materials and Nano materials for the various applications.	1,2,3,6	1
CO5	Illustrate the fundamental principles of electrode systems, batteries, and super capacitors.	1,2,3,5,7	1
CO6	Explain the practical uses of advanced materials in engineering and technology.	1,2,3,7	1

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4				√		
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX:

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1				1						1		
CO2	2	1	3		1		2						1		
CO3	3	2	1		1		1						1		
CO4	3	2	1			1							1		
CO5	3	2	1		1		2						1		
CO6	3	2	1				1						1		

Note:1-Low; 2-Medium; 3-High

COURSE CONTENTS:

Sensors: Introduction, types, principles, and applications of thermal, optoelectronic, piezoelectric, electrochemical, bio, and gas sensors.

Principles, instrumentation, and applications of UV-visible spectrophotometry, flame photometry, potentiometry, and conductometry.

Hands-on-practice: Quantification of Bio molecules/ sodium/ potassium and iron.

Clean Energy Storage and Conversion Device Technologies

Energy storage devices: Types of electrodes, Battery components and characteristics: Primary battery (dry cell, Li-MnO_2), secondary battery (lead-acid, Li-ion).

Hands-on-practice: Assembly and Fabrication of Daniel cell. Detection of acidity, alkalinity and pH of a soil by automated electrode.

Case study: Choice of battery materials for e-vehicles

Supercapacitors: The electrochemical double Layer-Helmholtz model, charge accumulation mechanisms in EDLC, pseudo and hybrid capacitors with applications.

Photovoltaic cell: Principle, purification of Materials, working, advantages and applications.

Hands-on-practice: Fabrication of dye sensitized solar cell

Electro less plating: Principle of electro less plating, manufacture of Printed circuit board using electroless plating of copper and applications.

Hands-on-practice: Electro plating and electro less plating of copper.

Case study: Materials for printed circuit boards.

Polymeric Materials: Introduction, biodegradable and biocompatible polymeric materials. Conducting polymers-electron transport mechanism, and applications of poly acetylene and poly aniline.

Hands-on-practice: Thin film fabrication of a conducting polymer for device applications by a) electro polymerization b) chemical oxidative method.

Liquid crystals: Classification, and applications in electronic display systems.

Nanomaterials: Introduction, classification, and quantum confinement. Size-dependent properties.

Hands-on-practice: Preparation of semiconducting nanomaterials.

Smart materials for signal conversion: Solvetochromism, Mechanochromism, Piezoelectric materials, shape memory alloys, electro active materials, magnetorheological materials, photochromic materials and magnetostrictive materials.

Hands-on-practice: Study of optical band gap of quantum dot semiconducting nanoparticles by UV-Visible spectrophotometer.

Case study*:* Recent advances in nanotechnology for flexible electronic devices.

Fast Learners: 1. Average molecular weight determination by viscosity method.
2. Industrial Wastewater treatment by Photocatalysis.
3. Preparation of Polystyrene and Phenol - Formaldehyde or Urea - Formaldehyde Resin.
4. Membrane preparation for water purification.

Self-Learning Component: Chemical Structure drawing (2D &3D), energy minimization by using ISIS draw, Avogadro software, Auto Dock software, and Various types of plots using Origin software.

TEXTBOOKS:

1. R.V. Gadag and Nithyanandashetty N, “Engineering Chemistry” Ik International Publishing house, 3rd edition, 2014.
2. B. Siva Shankar, “Engineering Chemistry”, Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
3. S. S. Dara, Mukkanti, “Text of Engineering Chemistry”, S. Chand & Co, New Delhi, 12th Edition, 2006.
4. B.S. Jai Prakash, R.Venugopal, Sivakumaraiah & Pushpa Iyengar., “Chemistry for Engineering Students”, Subhash Publications, Bangalore.
5. R. P. Mani, K. N. Mishra, “Chemistry of Engineering Materials”, Cengage Learning, 3rd Edition, 2015.
6. P. C. Jain, Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company, 17th Edition, 2015.
7. D. Singh, B. Deshwal, S. . Vats, “Comprehensive Engineering Chemistry”, Dreamtech Press, 2020.

REFERENCE BOOKS:

1. V.R. Gowariker, N.V. Viswanathan & J. Sreedhar., “Polymer Science”, Wiley-Eastern Ltd. Callister W.D., “Materials Science and Engineering”, John Wiley & Sons, 10th edition, 2013.
2. B. M Chandrashekar and B.C. Basavaraju, ‘’Engineering Chemistry’’Basuchandras Publishing 3rd edition 2016.
3. S. Agarwal ‘’Engineering Chemistry’’, Cambridge University Press, 2nd edition, 2019.
4. O.V. Roussak and H. D. Gesser , Applied Chemistry: A textbook for Engineers and Technologists, Springer New York, NewYork, 2nd edition, 2013.
5. V.M. Balsaraf, ‘’Applied Chemistry-II’’, Dreamtech Press, 1st edition, 2020.
6. B. Bhardwaj ‘’Applied Chemistry’’, S.K. Kataria & Sons, 2nd edition, 2024.

Additional Links:

1. **https://www.youtube.com/watch?v=JlZhHhpVRrI**
2. **https://www.youtube.com/watch?v=xAS4NS9RuI4**
3. **https://www.youtube.com/watch?v=KvdlWobaBkM**
4. **https://www.youtube.com/watch?v=HTFjHINBJts**
5. **https://www.youtube.com/watch?v=iFVVv23ZzGE**

Course Title	**BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING**				**Course Type**		**HC**	
Course Code	**B24EE0101**	**Credit**	**03**		**Class**		**I semester**	
Course Structure	LTP	Credit	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	**CIE**	**SEE**
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

This course introduces the basic concepts of electrical as well as electronics engineering. This course provides the knowledge of electrical power generation through hydro, thermal , wind and solar energy sources. Provides the basic knowledge of smart grid and electric vehicle systems. It also helps the students to understand applications of semiconductor devices such as Diodes and BJT along with their characteristics and applications. This course provides better understanding of digital electronics.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain and to make the students familiar about the basics of Electrical Circuits.
2. Illustrate the basics of magnetic circuits, DC machines, Transformers and domestic protection system
3. Illustrate the characteristics of semiconductor devices and their applications
4. To familiarize the students about digital circuits

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO-1	Explain and apply Ohm's Law, Kirchhoff's Current Law (KCL), and Kirchhoff's Voltage Law (KVL) in DC circuit analysis.	1,2	1
CO-2	Analyze RL, RC, and RLC circuits in series and parallel configurations and interpret phasor diagrams for single phase and 3-phase ac systems.	1,2	1
CO-3	Understand the working of Hydro electric power plant, thermal power plant , wind and solar power plants and grid integration of solar power plants.	1,2,7	1,3
CO-4	Familiarize with components of smart grid and electric vehicle.	1,2,7	1,3
CO-5	Describe the operation and characteristics of semiconductor diodes, Zener diodes, bipolar junction transistors (BJTs) and their applications.	1,2	1
CO-6	Apply Principles and theorems of Digital Electronics to simplify the logic expressions, converting between number systems and designing logic circuits using basic gates.	1,2	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			✓			
CO2				✓		
CO3		✓				
CO4		✓				
CO5		✓				
CO6			✓			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											1		
CO2	3	3											1		
CO3	3	2					2						1		1
CO4	2	2					2						1		1
CO5	3	3											1		
CO6	3	2											1		

Note:1-Low,2-Medium,3-High

COURSE CONTENTS

Introduction to Electrical engineering: Basics of DC Circuits: Ohms law, Kirchhoff's Current Law, Kirchhoff's Voltage law, Numerical examples as applicable. Basics of AC Circuits: Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation, RL, RC and RLC series and parallel circuits, power factor, phasor diagrams. 3-phase circuits- Star and Delta connections.

Electrical Power generation: An Overview of generation, transmission and distribution system. Hydro Electric Power plant- Layout, working, factors for selection of site, classification, merits and de merits. Thermal Power Plant- Layout, working, merits and demerits, Wind power plant- General layout, working, factors for site selection, merits and demerits, Solar Power Plant- General arrangement and operation, Basic concepts of on-grid PV systems, merits and de merits.

Smart Grid : Introduction, components of smart grid, comparison between conventional and smart grid.

Electrical Vehicle: Schematic of Electric Vehicle, Classification.

Self learning component: Hybrid Electric Vehicle.

Semiconductor Diodes and Transistors: Semiconductor Diodes: P-N junction diode, V-I Characteristics, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators, Clipping and clamping circuit, Numerical examples as applicable. Transistors: Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.

Digital Electronics and Number System: Introduction, Switching and Logic Levels. Number Systems and its conversions: Decimal Number System, Binary Number System, Hexadecimal Number System, Binary addition, Binary subtraction. Boolean Algebra Theorems, DeMorgan's theorem. Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions. Realization of basic gates using universal gates.

Self Learning Component: Hybrid Electric Vehicle.

TEXT BOOKS:

1. Nagrath I.J. and D. P. Kothari, "Basic Electrical and Electronics Engineering", Second Edition Tata McGraw Hill, 2020.
2. Hayt and Kimberly, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Hill, 2013.
3. Electrical power generation Manish Goel, Gaurav Guptha Laxmi publications Pvt Limited, First edtition,2011
3. Kulshreshtha D.C., "Basic Electrical Engineering", Second Edition, Tata McGraw Hill, 2019.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
5. Electric and Hybrid Electric Vehicles -Published by Pearson, 1st edition, (June 7, 2022) © 2023.
6. "Smart Grid: Technology and Applications" by Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama
(Wiley, 1st Edition, 2012

.

REFERENCE BOOKS:

1. . Hughes, “Electrical Technology”, International Students 9th Edition, Pearson, 2005.

2. Robert L. Boylestad and Louis Nashelsky, “Introduction to Electricity, Electronics and Electromagnetics” Prentice Hall, 5th edition.2001

3. “Electrical power generation transmission and distribution” edited by Leonard Grigby, 3rd Edition,2012

4. Textbook of Digital Electronics 0th Edition, Kindle Edition by S.S. Bhatti Rahul Malhotra, 2011

5. "Smart Grid Security: Innovative Solutions for a Modernized Grid" by Florian Skopik, Erich Wenger (Syngress, 1st Edition, 2015)

Additional material:

SWAYAM/NPTEL/MOOCS

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091
3. https://www.udemy.com/course/basic-electrical-engineering-part-1

<table>
<tr><td>Course Title</td><td colspan="4">Fundamentals of Data Science</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24CS0104</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>2</td><td>2</td><td>2</td><td>28</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: Set Theory, Probability theory, Tools for data science, ML algorithms and demonstration of experiments either by using MS-Excel/Python/R.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Illustrate the use of basic concepts of Data Science in the real-world applications.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real-world applications.	1 to 4, 12	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5,12	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1, 2, 3
CO4	Demonstrate visualization of Data using python libraries	1 to 5, 8 to 10	1,2, 3
CO5	Find modeling Error in Linear Regression.	1 to 5	1, 2, 3
CO6	Use statistical principles to solve mean and standard deviations for given data.	1 to 4, 12	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√
CO5		√				
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2								2	3	1	1
CO2	2	3	2	1	2	2						2	3	2	2
CO3	2	3	3	2	2								3	3	3
CO4	3	3	3	2	2			2	2	2			3	3	3
CO5	2	3	2	2	2								3	3	3
CO6	3	3	2	2								2	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Microsoft Excel: History and importance of Microsoft Excel, Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Sorting, Filtering, Grouping, Ungrouping and Subtotal. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel.

Import XML Data into Excel, How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.

Introduction to Data Science: What is Data Science? Applications of Data Science, Data science life cycle, Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection.

Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents.

Introduction to SQL: SQL Commands experimental demonstrations-DDL, DML, DCL, TCL, DQL. Import SQL Database Data into Excel.

Data Relationship Methods: Introduction to Correlation, Description of linear regression and Logistic Regression, Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.

Introduction to Statistics and Python: Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data.

Python basics, Strings, Lists, Tuples, Sets, Dictionaries. Introduction to python libraries - Numpy, Matplotlib, Pandas, Scikit-Learn, Implementation of ML.

Self Learning Component:

1. Relational database management system.
2. Advanced MS-Excel and JMP(SAS) tool

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”,43rdEdition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, “Database Management systems”, 3rdEdition, McGraw Hill Publications, 2003.
3. “Mastering Data Analysis in Excel” - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, “Data Analysis with Microsoft Excel”, S. Chand & Company,2004.
5. Joel Grus,”Data science from scratch - First principles with Python” , OâReily, 2015.

REFERENCE BOOKS:

1. B.V. Ramana, “Higher Engineering Mathematics”, 19th edition, Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, “Advanced Engineering Mathematics”, 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, “Schaum's Outline of Introduction to Probability and Statistics”, McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253IEEE Magazine on Big data and Analytics

SWAYAMNPTEL/MOOCs

1. Excel Skills for Business: Essentials, Macquarie University (https://www.coursera.org/learn/excel- essentials)
2. SQL for Data Science, University of California, Davis(https://www.coursera.org/learn/sql-for-data-science)
3. Data Science Math Skills, Duke Universityhttps://www.edx.org/course/subject/data-science
4. https://onlinecourses.nptel.ac.in/noc19_cs60/preview

Course Title	**Fundamentals of C programming**				**Course Type**		**HC**	
Course Code	**B24CI0109**	**Credits**	**2**		**Class**		**I Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	otal Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	**2**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the basic structure and history of the C programming language, and set up an environment to execute simple programs.
2. Write programs in modules using functions and recursive calls to achieve modularity
3. Understand and utilize concepts of arrays and pointers to write efficient programs.
4. Memory management: Effectively use the memory management system to achieve minimal compilation and execution time.
5. Use algorithms and flowcharts as fundamental tools for problem-solving in C programming**.**

COURSE OUTCOMES(CO'S)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the foundational concepts of the C language, including its history and basic building blocks..	1-3	1
CO2	Utilize conditional and unconditional control flow statements to write efficient programs.	1-5	1
CO3	Understand strings and library functions on strings.	1-5	1
CO4	Apply functions and recursive function calls to achieve modularity.	1-3,5	2,3
CO5	Manipulate pointers to write efficient programs.	1-5	2,3
CO6	Explore command line functionalities to control programs from command prompt.	1-5	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1				✓		
CO2			✓			

CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	3										3		
CO2	1	3	2	2	2								3		
CO3	2	2	2		1									3	3
CO4	3	3	3	1	1									3	3
CO5	3	3	3	2	2										
CO6	3	3	3	2	2				3				3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

1. Introduction to C Programming: Overview of C language, Structure of a C program, Compilation and execution, Basic syntax and semantics, Variables and data types, Constants and literals and Input and output operations

2. Building Blocks of C: Arithmetic operators, Relational operators, Logical operators, Bitwise operators, Assignment operators, Conditional operator, Precedence and associativity of operators and Type conversion

3. Control Statements: Decision making with if and if-else, Nested if-else statements, switch case statements, looping constructs: for, while, and do-while loops, Nested loops, break and continue statements and goto statement and labels

4.Functions: Defining and calling functions, Function prototypes, Scope and lifetime of variables, passing arguments to functions, Return values and Recursive functions

5. Arrays & Strings One-dimensional arrays, Multidimensional arrays, Array initialization and manipulation, Strings and string functions and Array of strings, matrix operations using 2-dimensional arrays.

6. Pointers: Understanding pointers, Pointer arithmetic, Pointers and arrays, Pointers and strings, Pointers to functions, Pointers and dynamic memory allocation, Introduction to structures and unions.

Self-Learning Component:

1. Evaluations of programming languages
2. Different programming languages and their applications in real world
3. Know more about most popular programming languages in the world by using : https://www.tiobe.com/tiobe-index/

TEXT BOOKS:

1. Herbert Schildt, "C: The Complete Reference", 4th edition, TATA McGraw Hill, 2000.
2. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL SOFTWARE SERIES, 2005.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A Holistic Approach", second edition, PHI,2008.
4. Yashavant Kanetkar, "Let us C" , BPB , 19th edition, 2022

REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker," Computer Graphics C Version", second edition, Pearson Education, 2004.
3. **Jon Bentley, "**Programming Pearls", 2nd edition, PEARSON,2002.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294 (IEEE Journal/Magazine on IT Professional)
2. https://ieeexplore.ieee.org/document/1267572 (IEEE Computing in Science and Engineering)

SWAYAMNPTEL/MOOCs

1. https://online courses.nptel.ac.in/noc20_cs06/preview (Problem Solving through Programming in C)
2. https://www.edx.org/course/c-programming-getting-started (C Programming Getting started)
3. https://www.coursera.org/specializations/c-programming (Introduction to C programming)

<table>
<tr><td>Course Title</td><td colspan="4">Fundamentals and Applications of Civil Engineering</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24ED0102</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact hours</td><td>Work load</td><td colspan="2" rowspan="2">Total Number of Classes per semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW

This course, serves as an introductory exploration into the diverse realms of civil engineering, emphasizing the integration of software tools and applications. It covers fundamental fields of civil engineering, including infrastructure development, construction materials, traffic management, Geo Informatics and smart city solutions. The course aims to bridge traditional civil engineering practices with modern techniques, providing students with the knowledge and skills necessary to address contemporary engineering challenges.

COURSE OBJECTIVES

The objective of this course are to

1. Know the various fields and scope of Civil Engineering and the socio-economic impact of different infrastructure types.
2. To develop the ability to analyze forces, support reactions, and loads in engineering mechanics, focusing on both concurrent and non-concurrent force systems.
3. To analyze and visualize the load distribution, shear force, bending moments and deflections of statically determinate beams using tools.
4. To understand the principles of transportation engineering, classification of roads, pavements, application of Intelligent Transportation Systems (ITS) and smart cities.
5. Use of geo-informatics principles, including remote sensing, GIS, and image processing, and apply these concepts in practical scenarios through case studies.
6. Create cross-sectional views of different road types and understand their practical applications.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: Understand the scope and fields of Civil Engineering, types of infrastructure, and their socio-economic impact.

CO2: Analyze forces, support reactions, and loads in engineering mechanics.

CO3: Analyse and visualize the load distribution, shear force, bending moments and deflections of statically determinate beams using tools.

CO4: Understand transportation engineering principles, including road classification, ITS and smart cities.

CO5: Utilize geo-informatics principles for remote sensing, GIS, and image Processing.

CO6: Apply software tools and create road cross-sections and understand their practical applications.

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2		✓	✓	✓		
CO3		✓	✓			
CO4		✓	✓			
CO5		✓	✓	✓		
CO6		✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3				3	3					3	3			
CO2	3	3		2					3	3		3	3	3	1	
CO3	3	3		3			2		3	3		3	3	3	1	
CO4	3	3				3	3			3		3	3	3	1	
CO5	3	3		3		3						3	3	3		1
CO6	3	3					3					3	3	3		1

COURSE CONTENT

Introduction to Civil Engineering - Scope of different fields of Civil Engineering. Types of infrastructure, Importance of Infrastructural Development, Effect of the infrastructural facilities and social-economic development of a country. Construction materials.

Engineering Mechanics: Forces and Classification, analysis of concurrent force systems and non-concurrent force systems-resultants. Types of loads, supports and beams. Numerical problems on beams: Calculation of support reactions with point load, uniformly distributed load and moments.

- Load applications and analysis: To visualize the load distribution, shear force, bending moments and deflections of statically determinate beams using Staad Pro/MS Excel.

Transportation Engineering: Classification of Roads and their functions, Flexible and Rigid Pavements. Road safety and management, Causes - Collection of data for traffic studies, Traffic management techniques, ITS and its application. **Smart cities:** Smart energy resources, Smart disposal of solid waste, smart road construction.

- Create cross-sectional views of different road types using AutoCAD software

Geo Informatics: Principles of remote sensing - Satellites and Sensors, Introduction to GIS principles, Global positioning system, Introduction to image processing and its application. Case studies.

TEXT BOOKS

1. Elements of Civil Engineering Jagadeesh, T. R., & Jayaram, M. A. Sapna Book House. ISBN: 978-8120341675
2. Engineering Mechanics. Khurmi, R. S. S. Chand & Company Ltd. ISBN: 978-8121901014
3. Environmental Engineering. Rao, P. V. (2002)Prentice-Hall of India Pvt. Ltd. ISBN: 978-8123919352
4. Remote Sensing and GIS Bhatta, B. Oxford University Press. ISBN: 978-0198072393
5. Traffic Engineering and Transport Planning. Kadiyali, L. R. Khanna Publishers. ISBN: 978-8185596780
6. Building Construction. Punmia, B. C., Jain, A. K., & Jain, A. K. Laxmi Publications. ISBN: 978-8131804289

REFERENCE BOOKS

1. Structural Health Monitoring. Balageas, D., Fritzen, C. P., & Güemes, A. John Wiley & Sons. ISBN: 978-0470394381
2. Principles of Geotechnical Engineering. Das, B. M. Cengage Learning. ISBN: 978-0495668107
3. Geographic Information Systems and Science. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. John Wiley & Sons. ISBN: 978-0470721446
4. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia. Townsend, A. M. W.W. Norton & Company. ISBN: 978-0393349786

Construction Project Management: A Practical Guide to Field Construction Management (. Sears, S. K., Sears, G. A., & Clough, R. H. John Wiley & Sons. ISBN: 978-1118745052

Course Title	Fundamentals of Data Science Lab				Course Type		HC	
Course Code	**B24CS0108**	**Credits**	**1**		**Class**		**I Semester**	
Course Structure	LTP	Credits	Contact Hours	Workload	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50**	**50**

COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: ML algorithms, SQL and demonstration of experiments by using MS-Excel and MySQL and Python.

COURSE OBJECTIVE (S):

1. The objectives of this course are to:
2. Explain the fundamental concepts of Excel.
3. Explain the algorithms of Machine learning.
4. Demonstrate the use of SQL commands in real world applications.
5. Discuss the functional components of Data Science for real world applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Microsoft Excel in developing the real-world applications.	1 to 5, 8 to 10	1,2,3
CO2	Apply the SQL Queries in developing the real-world applications.	1 to 5, 8 to 10	2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using regression algorithms.	1 to 5, 8 to 10	1, 2, 3
C04	Design ER diagrams for database.	1 to 5, 8 to 10	1, 2, 3
CO5	Use Excel to solve Multiple Linear Regression.	1 to 5, 8 to 10	1, 2, 3
CO6	Demonstrate visualization of Data using python libraries	1 to 5, 8 to 10	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply(L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1			✓			
CO2			✓			
CO3			✓	✓		

C04			✓	✓	✓	✓
CO5		✓				
CO6			✓			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2			1	3	3			3	3	3
CO2	2	2	2	2	2			1	3	3			3	3	3
CO3	3	3	2	2	2			1	3	3			3	3	3
CO4	3	3	3	2	2			1	3	3			3	3	3
CO5	3	3	3	2	2			1	3	3			3	3	3
CO6	3	3	3	2	2			1	3	3			3	3	3

Practice:

<table>
<tr><th>No</th><th>Title of the Experiment</th><th>Tools and Technics</th><th>Expected Skill/Ability</th></tr>
<tr><td>1</td><td>The height (in cm) of a group of fathers and sons are given below, Findthe lines of regression and estimate the height of son when the height of father is 164 cm.
<table>
<tr><td>Hgt of Father</td><td>158</td><td>166</td><td>163</td><td>165</td><td>167</td><td>170</td><td>167</td><td>172</td><td>177</td><td>181</td></tr>
<tr><td>Hgt of Son</td><td>163</td><td>158</td><td>167</td><td>170</td><td>160</td><td>180</td><td>170</td><td>175</td><td>172</td><td>175</td></tr>
</table></td><td>MS Excel And JMP Tool</td><td>Create and perform operations on Excel data set by applying Linear regression</td></tr>
<tr><td>2</td><td>Using the data file DISPOSABLE INCOME AND VEHICLE SALES,perform the following:
i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trend line feature.
iv) Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900.
v) Compute the coefficient of determination and the coefficient of correlation</td><td>MS Excel And JMP Tool</td><td>Perform prediction and visualiza- tion of data</td></tr>
</table>

<table>
<tr>
<td>3</td>
<td>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.
i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trend line feature).
iv) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
v) Compute the coefficient of determination and the coefficient of correlation.</td>
<td>MS Excel And JMP Tool</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>4</td>
<td>Apply multiple linear regression to predict the stock index price which is a dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.
<table>
<tr><th>Year</th><th>Month</th><th>Interest rate</th><th>Un employment rate</th><th>Stock index price</th></tr>
<tr><td>2022</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr>
</table>
</td>
<td>MS Excel And JMP Tool</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>5.</td>
<td>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10,00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for availed of Rs.10, 00,000during 3 years.
<table>
<tr><th>Sl.no</th><th>A</th><th>B</th></tr>
<tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr>
<tr><td>2</td><td>Annual interest rate</td><td>5.2%</td></tr>
<tr><td>3</td><td>Year of the loan</td><td>3</td></tr>
<tr><td>4</td><td>Starting payment number</td><td>1</td></tr>
<tr><td>5</td><td>Ending payment number</td><td>36</td></tr>
<tr><td>6</td><td>Total interest paid during period</td><td>?</td></tr>
</table>
</td>
<td>MS Excel And JMP Tool</td>
<td>Create Excel data and perform EMI estimator</td>
</tr>
<tr>
<td>6</td>
<td>Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO should not be NULL.</td>
<td>SQL</td>
<td>Creating Tables</td>
</tr>
<tr>
<td>7</td>
<td>Create the customer database of a big Market with CUSTOMER_ ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_ CODE. Store at least twenty customer’s details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.</td>
<td>SQL</td>
<td>Creating and retrieving Tables</td>
</tr>
<tr>
<td>8</td>
<td>Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.</td>
<td>MS Excel And JMP Tool</td>
<td>Apply Linear regression</td>
</tr>
<tr>
<td>9</td>
<td>Apply Multiple linear regression to predict the factory products which is A, B and C are independent variables and cost dependent variable.</td>
<td>MS Excel And JMP Tool</td>
<td>Apply Linear regression</td>
</tr>
<tr>
<td>10</td>
<td>Logistic Regression-case study using Kaggle Database</td>
<td>MS Excel And JMP Tool</td>
<td>Apply Logistic regression</td>
</tr>
</table>

11	Design the ER diagram and create schema of the REVA library Management system.	Entity Relationship	Entity Relationship
12	Perform Exploratory Data Analysis to predict customer churn in telecommunications company using Python libraries such as Pandas, and Matplotlib to aid in this process. (Use datasets from Kaggle/NCBI.)	Jupyter/Colab - Python	Apply Exploratory Data Analysis
13	“LIST1” is a list that contains “N” different SRN of students read using a user defined function with the help of input() function. It is required to add SRN of “M” more students that are to be appended or inserted into “LIST1” at the appropriate place. The program must return the index of the SRN entered by user.	Jupyter/Colab - Python	Create and perform operations on list.
14	“TUPLE1” and “TUPLE2” are two tuples that contain “N” values of different data types read using the user defined function “READ” with the help of input() function. Elements of “TUPLE1” and “TUPLE2” are to be read one at a time and the “larger” value among them should be placed into “TUPLE3”. Display all tuples.	Jupyter/Colab - Python	Create and perform operations on Tuples.

PART_B:Projects

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Big Mart sales forecasting	MS Excel	Apply Linearregression
2	Bangalore crime analysis	MS Excel	Apply Linearregression

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”, 43rd edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, “Database Management systems”, 3rd Edition, McGraw Hill Publications, 2003.
3. “Mastering Data Analysis in Excel” - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, “Data Analysis with Microsoft Excel”, S. Chand & Company,2004.

REFERENCE BOOKS:

1. B.V. Ramana, “Higher Engineering Mathematics”, 19th edition, Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, “Advanced Engineering Mathematics”, 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, “Schaum's Outline of Introduction to Probability and Statistics”, McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060_International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253_IEEE Magazine on Big data and Analytics

<table>
<tr><td>Course Title</td><td colspan="4">BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EE0102</td><td>Credit</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Basic Electrical & Electronics Engineering lab covers the concept of various types of electrical apparatus, tools, and conduction of experiments to Analyse, Design of KCL & KVL, two-way switch or staircase wiring, Determination of VI characteristics Zener Diode, Silicon Diode, Half Wave rectifier using Diode, study& analyses of Lead & lag component, verification of logic gates.

COURSE OBJECTIVES

The objectives of this course are to:

1. Establish a broad concept of various types of electrical apparatus, tools and instrumentation.
2. provide hands on experience with electrical apparatus and electrical safety norms.
3. Train students to read and understand schematics so as to make electrical connection for different appliances.
4. Train students in collecting and interpreting experimental data.
5. Enhance written skills of students.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Use appropriate electrical tools for electrical connections and repair of equipment's	1,2,4,5	1
CO2	Recognize various symbols in a schematic and make connection as per circuit diagram	1,2,9,10	1
CO3	List out various safety procedures	4,5,9,10	1
CO4	Make use of various measuring instruments to collect experimental data	2,4,9,10	1
CO5	Analyse the results obtained from experiments.	2,3,9,10	1
CO6	Demonstrate the ability to critically evaluate the performance of electrical appliances.	1,2,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				

CO3	✓					
CO4			✓			
CO5				✓		
CO6					✓	

COURSE ARTICULATION MATRIX:

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		3	3								1		
CO2	3	3											1		
CO3				3	3								1		
CO4		3		3									1		
CO5		3	2												
CO6	3	2													

Note:1-Low,2-Medium,3-High

COURSE CONTENT

List of Experiments:

S. No.	**Name of the Practice Session**
1	To verify KCL and KVL for the given circuit both practically and theoretically.
2	Simulation of RL and RC circuit using PSIM and power factor Calculation.
3	Staircase wiring circuit layout for multi storage building
4	To study and verify series and parallel circuits.
5	Study and analysis of Voltage regulator using Zener Diode
6	Demonstration of Clamper circuit with reference voltage
7	Design half wave, Full wave-centre tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.
8	Demonstration of Clippers with reference voltages
9	Study and analysis of input output Characteristics of CE configuration of BJT.
10	Realization of basic gates using universal gates

Demo Experiments:

1. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.
2. To study the Importance and mechanism of MCB.

Textbooks

1. Nagrath I.J. and D. P. Kothari, “Basic Electrical Engineering”, Third Edition Tata McGraw Hill, 2009.

2. Hayt and Kimberly, “Engineering Circuit Analysis”, 8th Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., “Basic Electrical Engineering”, Tata McGraw Hill, 2009.
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall, India, 2009.

Reference Books

1. Theodore Wildi, “Electrical Machines, Drives, and Power, 5thSystems”, Pearson Edition, 2007.
2. Hughes, “Electrical Technology”, International Students 9th Edition, Pearson, 2005

SWAYAM/NPTEL/MOOCs

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091
3. https://www.udemy.com/course/basic-electrical-engineering-part-1

Course Title	**Computer Aided Engineering Drawing**				**Course Type**		**HC**	
Course Code	**B24ME0101**	**Credit**	**2**		**Class**		**I Semester**	
Course Structure	LTP	Credit	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	0	0	Theory	Practical	**CIE**	**SEE**
	Practical	1	2	2				
	Total	**2**	**3**	**3**	**14**	**28**	**50**	**50**

COURSE OVERVIEW:

Engineering Graphics or Drawing is known as language of engineers. All phases of engineering process require the conversion of new ideas and design concepts into the basic line language of graphics. There are many areas such as civil, mechanical, electrical, architectural, computer, electronics and industrial applications where knowledge and skills of the drawing play major roles in the design and development of new products or construction. This course emphasizes on orthographic projection of point, line, plane surfaces and solids. It also provides knowledge about representing the object in terms of 3D view and also development of the objects.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient.
2. Enable students to learn about the software tool for preparing engineering drawings
3. Teach the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids.
4. Communicate the concepts/ideas through the language of technical drawing and sketching.

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to:

CO	Course Outcomes	POs	PSOs
CO1	Apply orthographic projection principles to represent points accurately in multiple views with or without aid of CAD software, ensuring consistency and clarity in engineering drawings.	1,2,5,10	1
CO2	Apply orthographic projection principles to draw the projection of line accurately with or without aid of CAD software, ensuring consistency and clarity in engineering drawings.		
CO3	Develop a thorough understanding of the principles of projection, including how plane surfaces are projected onto projection planes in orthographic projection with or without aid of CAD software	1,2,5, 10	1
CO4	Learn how to visualize the shape, size, and features of solids in three dimensions and accurately represent them in orthographic projection drawings with or without aid of CAD software	1,2,5, 10	1
CO5	Develop a solid conceptual understanding of the development of lateral surfaces of solids such as prisms, pyramids, cylinders and cones with aid of computer, including the principles of unfolding or unwrapping the surfaces.	1,2,5, 10	1
CO6	Create isometric drawing of solids and combined solids and learn how to visualize and represent the individual components of the combined solid and assemble them into a coherent isometric projection using CAD software.	1,2, 3,5,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX:

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1			2					3			3		
CO2	3	2			2					3			3		
CO3	3	2			2					3			3		
CO4	3	2			2					3			3		
CO5	3	2	2		2					3			3		
CO6	3	1	2		2					3			3		

Note:1-Low,2-Medium,3-High

COURSE CONTENTS

Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software, Orthographic projection of points in first and third Quadrant only.

Orthographic projection of straight lines inclined to both horizontal and vertical planes.

Orthographic projection of regular plane surfaces -surface is inclined to both HP and VP.

Projections of Solids: Orthographic projection of regular solids like prisms, pyramids, cone and cylinder when the axis is inclined to both HP and VP.

Development of Lateral Surfaces of Solids: Parallel line method for prisms and cylinders, Radial line method for pyramids and cones

Isometric Drawing: Concept of isometric drawing and isometric projection, Isometric drawing of simple solid and combined solids (only 2 Solids).

PRACTICE:

Sl. No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analysing and software skill

Sl. No	Practice	Tools and Techniques	Expected Skill /Ability
3.	Draw the projection of straight lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of triangular and square lamina inclined to both HP and VP	Solid Edge Software	Analysing and software skill
5.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	Analysing and software skill
6.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	Analysing and software skill
7.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
8.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	Analysing and software skill
9	Drawing development diagram of lateral surface of prisms.	Solid Edge Software	Analysing and Software Skill
10	Drawing development diagram of lateral surface of pyramids	Solid Edge Software	Analysing and Software Skill
11	Draw the isometric drawing of two co-axial solids	Solid Edge Software	Creative and Software Skill
12	Draw the isometric drawing of two co-axial solids	Solid Edge Software	Creative and Software Skill
13	Draw the isometric drawing of two co-axial solids	Solid Edge Software	Creative and Software Skill

TEXT BOOKS:

1. K S Narayanswamy and Mahesh L, “Engineering Drawing”, WILEY Publishers, 1st Edition, 2017.
2. K. R. Gopalakrishna and Dr. M S Reddy, “Engineering Graphics-1”, Subhas Publications, 2015.
3. Bhatt N.D., Panchal V.M and Ingle P.R, “Engineering Drawing”, Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.

REFERENCE BOOKS:

1. Luzadder and Duff, “Fundamental of Engineering Drawing”, Printice Hall of India Pvt. Ltd. 11th Edition, 2001.
2. Shah, M.B. and Rana B.C., “Engineering Drawing and Computer Graphics”, Pearson Education, 2008.

SWAYAM/NPTEL/MOOCS

Additional material:

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://www.udemy.com/course/ed/

<table>
<tr><td>Course Title</td><td colspan="4">Fundamentals of C programming lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24CI0110</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Pseudocode, Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure-oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real-world applications.

COURSE OBJECTIVE (S):

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real-world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real-world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real-world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.
6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-3	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5	1
CO3	Develop text processing-based applications using string operations.	1-3,5	2,3
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2,3
CO5	Use algorithms and technologies in C Programming for suitable application development	1-5	2,3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9	2,3

BLOOM’S LEVELOF THECOURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3						3	3			3		
CO2	1	3	2	2	2				3	3			3		
CO3	2	2	2		1				3	3				3	3
CO4	3	3	3	1	1				3	3				3	3
CO5	3	3	3	2	2				3	3					
CO6	3	3	3	2	2				3	3			3	3	2

Note:1-Low,2-Medium,3-High

No	Title of the Experiment
1	Write a C program using switch statement to design a basic calculator that performs the basic operations such as addition, subtraction, multiplication, and division.
2	A quadratic equation as an equation of degree 2, meaning that the highest exponent of this function is 2. Write a C program to find the coefficients of a quadratic equation and compute its roots.
3	Develop a C Program to find the largest among two and three different numbers entered by the user.
4	A leap year is a calendar year that contains an additional day compared to a common year. Design and develop C program to check whether the given year is leap year (or) not.
5	A palindrome is a word, sentence, verse, or even number that reads the same backward or forward. Write a C program to check if a given number is a Palindrome.

6	Design and Develop a C Program to print the following pattern using Looping concepts. A B C D E F A B C D E A B C D A B C A B A *
7	Consider student's marks in Computer Test. Write a C Program to display the grade obtained by a student in Computer Test based on range of marks.
8	If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.
9	In computer-based applications, matrices play a vital role in the projection of three-dimensional image into a two-dimensional screen, creating the realistic seeming motions. Write a C program using 2-dimensional array to check for compatibility of two matrices and perform matrix Multiplication.
10	Write a C program to implement bubble sort with appropriate input and output.
11	Write a C program to implement binary search with appropriate input and output.
12	Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, “C: The Complete Reference”, 4th edition, TATA McGraw Hill, 2000.
4. B.S. Anami, S.A. Angadi and S. S. Manvi, “Computer Concepts and C Programming: A
5. Holistic Approach”, second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy,” Programming in ANSI C”, 4th edition, TATA MCGRAW Hill, 2008.

Donald Hearn, Pauline Baker,“ Computer Graphics C Version”, second edition, Pearson Education, 2004.

Course title	**Finance and Management**				**Course type**		**FC**	
Course code	**B24EN0102**	**Credits**	**1**		**Class**		**I Semester**	
	LTP	**Credits**	**Contact hours**	**Work load**	**Total Number of classes per semester**		**Assessment in weightage**	
	Lecture	**1**	**1**	**1**				
	Tutorial	**-**	**-**	**-**				
	Practice	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**1**	**1**	**1**	**14**	**-**	**50**	**50**

COURSE OVERVIEW

This course provides an introduction to the fundamentals of finance and management principles essential for understanding business operations and decision-making processes. It covers key concepts in finance such as the time value of money, financial markets, and institutions, along with principles of management including planning, organizing, leading, and controlling.

COURSE OBJECTIVES

1. Understand the concept of finance and its various applications in both personal and business contexts.
2. Evaluate various financial instruments, markets, and investment opportunities to make informed investment decisions.
3. Develop the ability to analyze financial situations using time value of money principles.
4. Apply management theories and techniques to effectively lead teams, manage conflicts, and enhance organizational performance.
5. Examine Henri Fayol's fourteen principles of management and their relevance to contemporary organizational practices.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course outcomes	POs	PSo
C01	Understand how financial principles influence everyday choices, such as savings, investment, and expenditure.	9,10,11,12	1
C02	Understand the role of financial intermediaries such as banks, investment banks, and stock exchanges.	9,10,11,12	1
CO3	Understand Frederick Taylor's scientific management theory and its emphasis on efficiency and productivity.	9,10,11,12	1
CO4	Identify the functions of management: planning, organizing, leading, and controlling.	9,10,11,12	1
C05	Understand theories of motivation and their application to employee behavior.	9,10,11,12	1
CO6	Develop effective communication skills and decision-making abilities essential for managerial roles, including interpersonal communication, conflict resolution, and problem-solving.	9,10,11,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
C01	✓	✓	✓			
C02	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓			
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PS01	PSO2	PS03
CO1									1	1	1	1	1		
C02									1	1	1	1	1		
CO3									1	1	1	1	1		
CO4									1	1	1	1	1		
C05									1	1	1	1	1		
C06									1	1	1	1	1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:

Introduction to Finance

Overview of Finance Definition and Scope of Finance Importance of Finance in Business and Personal Decision Making Goals of Financial Management Financial Markets and Institutions: Personal Financial Planning. Reading Understanding financial statements. Time Value of Money Concepts: Future Value, Present Value, Discounting Calculating Future Value and Present Value of Cash Flows Applications of Time Value of Money in Financial Decision Making Financial Markets and Institutions Types of Financial Markets: Money Market, Capital Market, Primary Market, Secondary Market Financial Instruments: Stocks, Bonds, Derivatives Role of Central Banks and Regulatory Bodies in Financial markets Principles of management.

Principles of Management

Management: Introduction- Meaning, nature and characteristics of management Definition of management Evolution of management thought Scope and Functions of management (Planning, Organizing, Leading, Controlling). Management as a science art or profession. Management and administration. Levels of management (Top, Middle, Front-line). Principles of management- Fayols principles of management. Taylor's Scientific Management Theory- Taylor’s Principles of Management, Maslow’s theory of Hierarchy of Human Needs, Douglas McGregor's Theory X and Theory Y- Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management..Porter's Five Force Model, BCG Matrix and PESTLE analysis.

Self Learning Component:

1. Study Future Value, Present Value, and Discounting concepts through online tutorials or videos.
2. Investigate examples of companies demonstrating social responsibility and their impact on stakeholders.
3. Explore how each financial instrument is traded and valued in the market.
4. Reflect on personal leadership qualities and areas for development.

TEXT BOOKS:

1. "TAXMANN’s Financial Management" by Ravi M. Kishore(2020) - Publisher: Taxmann Publications Pvt. Ltd. ISBN: 978-9389702385
2. Management Appannaiah, H. R. & Reddy, P. Second Revised Edition Himalaya Publishing House.

REFERENCE BOOKS

1. “Financial Management” Prasanna Chandra –Publisher: McGraw-Hill Education.(2020)ISBN-13: 978-9389143895
   Management Richard L. Daft Publisher: Cengage Learning.

Course Title	**Foundation for Learning**				**Course Type**		**MC**	
Course Code	**B24CS0109**	**Credits**	**0**		**Class**		**I Semester**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	**0**	**1**	**1**				
	Tutorial	**-**	**-**	**-**	Theory	Practical	CIE	SEE
	Practice	**0**	**-**	**-**				
	Total	**0**	**1**	**1**	**14**	**-**	**25**	**25**

COURSE OVERVIEW

This course was designed to provide students with hands-on experience and an in-dept understanding of fundamental key concepts considered crucial for personal and academic success. Students will engage in activities to explore, measure and learn about various evidence-based strategies or techniques that enhance their skills. Students will investigate and assess self-motivation, learn and use self-regulation skills, and develop resilience. They will also learn about self-efficacy, its assessment, and how to increase it. The practical's involve comprehending learning concepts, evaluating learning techniques, andcreating successful learning strategies. Students will also be enabled to take charge of their personal and academic life via goal setting, planning, and decision-making activities. These goals seek to offer students a thorough grasp and practical application of key psychological principles, hence promoting personal growth and academic achievement.

Pre-requisites

1. Willingness to examine personal strengths, weakness and behaviors.

Pedagogy

This course will be run at two levels of differentiated learning. Basic course will involve a series of sessions in auditorium where students will complete self-assessment for a given skill, attend a talk and then write a quiz. More engaged students will complete a series of home assignments that help them improve their skills with support from Class Mentors. Students will work in teams supporting each other to complete the activities and compete with other teams on basic student engagement related parameters. The pedagogy includes both Teacher-Centered and Learner Centered Approaches. Such as:

1. ICT Based learning
2. Direct Instruction learning
3. Flipped Classroom
4. Inquiry based learning
5. Kinesthetics Learning
6. Expeditionary Learning

COURSE OBJECTIVES

1. To explore **goal-setting, planning, decision making** and empower students to take control of their personal and academic functioning.
2. To understand the **principles of learning,** evaluate the effectiveness of different learning approaches and develop strategies for enhancing learning skills.
3. To understand, measure and explore techniques to enhance **self-motivation**.
4. To define **self-regulation**, assess and identify and practice self-regulation techniquesto improve focus and productivity.
5. To explore the concept of **resilience**, evaluate and learn methods for cultivatingresilience.
6. To comprehend the concept of **self-efficacy**, measure and learn to build and self-efficacy.

COURSE OUTCOMES

1. Students will explore goal setting and decision-making, be able to measure these skills, and adopt a proactive approach

to managing their future, leading to improved overall functioning and success.
2. Students will grasp the principles of effective learning, be able to evaluate their learning approaches, and identify techniques to strengthen their learning skills.
3. Students will gain a thorough understanding of self-motivation, be able to measuretheir levels of self-motivation, and identify various techniques to enhance it.
4. Students will be able to define and assess their self-regulation skills and identify techniques to improve them.
5. Students will explore the concept of resilience, be able to measure their resilience, andidentify techniques to enhance it.
6. Students will understand the concept of self-efficacy, be able to measure their self-efficacy, and identify techniques to enhance it.

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√	√			
CO5		√	√			
CO6		√	√			

COURSE ARTICULATION MATRIX

Note:1-Low,2-Medium,3-High

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2					1	3	3	2	2	0	0	0
CO2	3	3	3	2				2	3	3	2	3	0	0	0
CO3	2	2	2					1	2	2	2	2	0	0	0
CO4	3	3	2					2	3	3	2	3	0	0	0
CO5	2	2	2					1	2	2	2	2	0	0	0
CO6	3	3	3	2				2	3	3	2	3	0	0	0

COURSE CONTENT:

1. Taking charge of one's destiny: Introduction to Decision Making and Goal Setting, Assessment, Enhancement Techniques.
2. Learning to learn: Definition, Learning Types, Theories, Assessment, Enhancement Techniques.
3. Motivation: Definition, Types, Theories, Assessment and Interpretation, Consequences, and Techniques for Improvement.
4. Self-regulation: Definition, Assessment and Interpretation, Consequences, Enhancement Techniques.
5. Resilience: Definition, Assessment and Interpretation, Consequences, Techniques for Improvement.
6. Self-efficacy: Definition, Assessment and Interpretation, Consequences, and Techniques to Increase Self-efficacy.

TEXTBOOKS:

Worksheets containing informative material tailored to this course will be provided to the students in the classroom.

REFERENCE:

1. Snyder, C.R, Lopez, Shane. J & Pedrotti, Jennifer. Teramoto, *Positive Psychology*, Sage Publications India Pvt Ltd.,(2nd edition), 2011.
2. Branscombe, N R and Baron, R A. *Social Psychology*, Pearson India Education Services Pvt. Ltd.,14thedition, 2018.
3. UNICEF Azerbaijan, *Basic Life Skills Course Facilitator's Manual*, United Nations Children's Fund (UNICEF), Baku, Azerbaijan, 2011. [Online]. Available: https://www.unicef.org/azerbaijan/reports/basic-life-skills-course-facilitators-manual. [Accessed: 26-Jul-2024].
4. AIF, *Handbook on Activities for Life Skills*, American India Foundation (AIF), 2012. [Online]. Available:https://aif.org/wp-content/uploads/2017/04/LAMP-Life-Skills-Activity-Handbook.pdf
5. M0063_Life_Skills_Cover.indd (peacecorps.gov)
   SP_FacilitatorsManual_Life-skills_Aug2014.pdf (edu.na)

II Semester (Chemistry Cycle)

II Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/SC/OE/MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24AS0203	Probability and Statistics	FC	3	0	0	3	3	50	50	100	BSC
2	B24AS0202	Physics for Computer Science	FC	3	0	0	3	3	50	50	100	BSC
3	B24ME0105	Fundamentals of Mechanical Engineering	HC	3	0	0	3	3	50	50	100	ESC
4	B24CI0201	Advanced C programming and Applications	HC	2	0	0	2	3	50	50	100	ESC
5	B24EN0101	Internet of Things	HC	1	0	1	2	3	50	50	100	ESC
6	B24AS0208	Physics for Computer Science Lab	FC	0	0	1	1	2	25	25	50	ESC
7	B24CI0202	Advanced C programming and Applications Lab	HC	0	0	1	1	2	25	25	50	ESC
8	B24ME0102	Innovation & Entrepreneurship	FC	1	0	1	2	3	50	50	100	HSMC
9	B24AH0103	Communicative English	FC	0	0	1	1	2	25	25	50	HSCMC
10	B24CSET01	Engineering Exploration	FC	1	0	0	1	1	25	25	50	FC
11	B24CSET02	Emerging Technologies on Full Stack Web Development	ETC	1	0	0	1	1	25	25	50	ETC
TOTAL				**15**	**0**	**5**	**20**	**26**	**425**	**425**	**850**	

TOTAL SEMESTER CREDITS	**20**
TOTAL CUMULATIVE CREDITS	**41**
TOTAL CONTACT HOURS	**26**
TOTAL MARKS	**850**

Title	**Probability and Statistics**				**Course Type**		**FC**	
Course Code	**B24AS0203**	**Credits**	**3**		**Class**		**II semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	**-**	**-**	**-**				
	Total	**3**	**3**	**3**	**42**	**0**	**50**	**50**

COURSE OVERVIEW:

The course Probability and Statistics for Computer Science treats the most common discrete and continuous distributions, showing how they find use in decision and estimation problems, and constructs computer algorithms for generating observations from the various distributions. Probability in the design and analysis of randomized algorithms. Common randomized algorithms are things like Quicksort and Quickselect. Probabilistic method can also useful to prove various important results. Probabilistic methods used to prove some partition theorems that were then used to create efficient data structure.

COURSE OBJECTIVE (S):

1. Describe Curve fitting and regression in various problems in Computer Science and engineering fields.
2. Illustrate the applications of Probability and statistics in various computer science and engineering Fields like data mining, classification problems etc.,
3. Discuss Sampling theory concepts to solve various engineering problems like structured and unstructured data models
4. Demonstrate Stochastic problem as Markov model as a problem solving methods for systematic model buildings.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO-1	Solve the problems of Curve fitting and regression in various problems in Computer Science and Engineering fields.	1,2,4	1
CO-2	Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.	1,2,4	1
CO-3	Apply the concept stochastic processes and Markov processes in Operating System	1,2,4	1
CO-4	Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.	2,3,4	1
CO-5	Apply the concepts of test of hypothesis for means and proportions and confidence limits for means.	1,2,4	1
CO-6	Apply the concepts of student’s t-distribution and Chi-square distribution as a test of goodness of fit.	1,2,4	1

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1									3		
CO2	3	3		1									3		
CO3	3	3		1									2		
CO4		3		1									1		
CO5	2			1									1		
CO6		3		1									2		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Curve Fitting: Curve fitting by the method of least squares and fitting of the curves of the form,y = ax + b, y = ax2 + bx + c, y = aebx (*y = axb and y=abx)
Statistical Methods: Correlation-Karl Pearson’s coefficient of correlation- problems. Regression analysis- lines of regression, problems. Rank correlation. Case study on statistical methods for data analysis.
** Application: Curve fitting and statistics for data science.

Probability distributions: Random variables, Discrete and continuous probability distributions. Binomial, Poisson, normal distributions (only problems) and *exponential (definition with one /two examples).
** Application: Probability distribution in machine learning, Computer vision: object recognition and image segmentation Computer graphics: behaviour of light and other physical phenomena in computer graphics.

Joint Probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, and correlation coefficient. Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.
** Application: Stochastic processes and Markov processes in Operating System.

Sampling theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution. Chi-square distribution as a test of goodness of fit. Case study on sampling for machine learning. ** Application: Sampling process in computer graphics, sampling theory in machine learning

** Application: (i) Additional information providing to students only for knowledge.

(ii) Major part of assignments questions chosen from applications.

(iii) Students' presentations/seminars topics chosen from applications.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 43nd edition Khanna Publishers, 2015.
2. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller., "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", 19th Reprint edition, Tata McGraw Hill Publications, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", 4th edition, Narosa Publishing House, 2016.
3. Sundarapandian, "Probability, Statistics and Queueing theory", PHI Learning, 2009.
4. Dr. B. Krishna gandhi, Dr. T.K.V. Iyengar, Dr. M.V.S.S.N. Prasad&S. Ranganatham.,"Probability and Statistics"S. Chand Publishing, 2015.
5. J. K. Sharma "Operations Research theory and applications", 5th edition, Macmillan publishers, ,2013.

JOURNALS/MAGAZINES

1. https://www.hindawi.com/journals/jps/
2. https://www.journals.elsevier.com/statistics-and-probability-letters
3. http://www.isoss.net/japs/
4. SWAYAM/NPTEL/MOOCs:
5. https://www.coursera.org/browse/data-science/probability-and-statistics
6. https://nptel.ac.in/courses/111/105/111105041/
7. https://onlinecourses.swayam2.ac.in/cec20_ma01/preview

SELF-LEARNING EXERCISES:

1. Curve fitting for application problems, Regression analysis for a bivariate data.
2. Probability distribution- Geometric, gamma- distributions, Joint probability distribution of continuous random variables.
3. Sampling analysis of real time problems. Applications to computer science: Data mining, classification problems etc.

TEXT BOOKS:

1.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2.Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

REFERENCE BOOKS:

1.B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2.R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

Course Title	**Physics for computer science**				**Course Type**		**FC**	
Course Code	**B24AS0106**	**Credit**	**3**		**Class**		**II Semester**	
Course Structure	**LTP**	**Credit**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Practical							
	Total	**3**	**3**	**3**	**42**		**50**	**50**

COURSE OVERVIEW:

This course introduces the basic concepts of Physics and its applications in Computer Science Engineering courses by emphasizing concepts like Construction and working of Laser sand optical Fibers in point-to-point communication. Quantum Mechanics and its application in Quantum Computation and Haptic Technology. The course has basic laws, expressions, and theories which help to increase the scientific knowledge to analyse upcoming technologies. The course also consists of real-time applications and numerical examples, which makes the course interesting and attractive.

COURSE OBJECTIVES:

1. The objectives of this course are to:
2. Interpret the knowledge of lasers, and optical fibers and their applications in computer science.
3. Exemplifying the fundamentals of quantum mechanics and its applications in quantum computing.
4. Study physics related to computation aspects.
5. Interpret the properties of dielectric materials for sensor applications
6. Understand the fundamentals and importance of haptic technology.

COURSE OUTCOMES(COs):

On successful completion of this course, the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Describe the basic principles of lasers and relevant applications in computer science.	1,2,3	2
CO2	Apply the knowledge of dielectrics for different applications	1,2,3	2
CO3	Classify optical fibers with relevant applications	1,2,3	2
CO4	Discuss the fundamentals of quantum mechanics with applications	1,2,3	2
CO5	Illustrate the importance of quantum computation as an emerging technology.	1,2,3	2
CO6	Summarize the basics of haptic technology	1,2,3	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓			
CO2	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓				
CO5	✓	✓				
CO6	✓	✓				

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													1
CO2	3	2													1
CO3	3	2													1
CO4	3	2													1
CO5	3	2													1
CO6	3	2													1

Note: 1-Low,2-Medium,3-High

COURSE CONTENTS:

Lasers: Laser and the characteristics, Interaction of radiation with matter (induced absorption, spontaneous and stimulated emission); Expression for energy density of radiation at thermal equilibrium in terms of Einstein's coefficients, Conditions for laser operation (population inversion and Meta stable state); Requisites of laser system, semiconductor laser and its application in laser printing. Numerical.

Dielectric materials: Introduction, Polarization, susceptibility, polarizability, polarization mechanisms, Piezoelectric, pyroelectric and ferroelectric dielectrics, properties and applications

Optical Fibers: Construction and light propagation mechanism in optical fibres (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of core and cladding refractive indices, Condition for wave propagation in optical fibre, V-number and Modes of propagation, Types of optical fibres, Attenuation and reasons for attenuation, Applications: Explanation of optical fibre communication using block diagram, Optical source (LED) and detector (Photodiode) and their applications, Advantages and limitations of optical communications. Numerical.

Concepts leading to quantum mechanics: De-Broglie hypothesis, Expression for de-Broglie wavelength of an electron in terms of accelerating potential. Phase velocity and group velocity, Relation between phase velocity and group velocity in terms of C, relation between particle and group velocity. Numericals

Quantum Physics: Need for quantum mechanics, Wave function, properties of wave function and physical significance. Probability density and Normalization of wave function, Schrodinger independent wave equation, Eigen values and Eigen functions. Applications of Schrödinger wave equation – energy; Eigenvalues of a free particle, Particle in one dimensional infinite potential well with numerical examples. Quantum structures, quantum wire, quantum well and quantum dot structures.

Quantum Computation: Quantum bits and representation of qubits, distinction between classical bit and quantum bit,quantum logic gates; Qubit as a two-level system. Introduction to quantum Information technology and quantum cryptography. Distinction between classical computer and quantum computer; Open challenges in quantum computation.

Introduction to Haptics: Types and importance of Haptics

Self-Learning Component:

Holograms using LASERs; Ultrasonics; and Statistical Physics for Computing

TEXTBOOKS:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University press, New York, 2nd Ed, 2004
2. Halliday, R. Resnick, and J. Walker, “Fundamentals of Physics”,John Wiley and Sons, New York, 10th edition, 2013.
3. R. K. Gaur and S.L. Gupta, “Engineering Physics”, Dhanpat Rai Publications (P) Ltd, New Delhi. 10th Ed, 2014.
4. M.N. Avadhanulu and P.G. Kshirsagar, “A textbook of Engineering Physics”, S. Chand and Company, New Delhi, 17th Ed, 2014.
5. Lorrain and O. Corson, “EM Waves and Fields”,3rd Ed, CBS Publishers, 2003.
6. Dr. Nidhi, Ismail Keshta, Dr. Abhishek Agarwal, Dr. Vandana Rathore, “Quantum computing for beginners”, Xoffencer International Publisher, 1st Ed, 2023.
7. Martin Grunwald, “Human Haptic Perception Basics and Applications”, Springer Basel AG, 1st Ed, 2008.
8. R.A., Serway, John W. Jewett, Physics for Scientists and Engineers, Technology, Lachina publishing Services, 9th Ed, 2015.

REFERENCEBOOKS:

1. Arthur Beiser, “Concepts of modern Physics”, Tata McGraw Hill publications, NewDelhi, 8th Ed, 2011.
2. S. O. Pillai, “Solid State Physics”, New Age International publishers, New Delhi, 9th Ed, 2010.
3. Michael A. Nielsen, Isaac L. Chuang,” Quantum Computation and Quantum Information”,Cambridge University Press, 1st Ed, 2010.

Additional material:

1. LASER: https://www.youtube.com/watch?v=WgzynezPiyc
2. Optical Fiber : https://www.youtube.com/watch?v=N_kA8EpCUQo
3. Polarization: https://www.youtube.com/watch?v=KBJl1qiYOgo
4. Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
5. Quantum Computing : https://www.youtube.com/watch?v=jHoEjvuPoB8
6. Quantum Computing :https://www.youtube.com/watch?v=ZuvCUU2jD30
7. Statistical Physics Simulation : https://phet.colorado.edu/sims/html/plinko-probability/latest/plinkoprobability_en.html
8. NPTEL Quantum Computing : https://archive.nptel.ac.in/courses/115/101/1151010

<table>
<tr><td>Course Title</td><td colspan="4">Fundamentals of Mechanical Engineering</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24ME0105</td><td>Credit</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>0</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course is designed to understand the concepts of green energy, hybrid vehicles, IC engines, refrigeration and air condition system, mechatronics, control systems, advanced manufacturing and automation. Further, this course includes applications of python programming for mechanical engineering. The students will be imparted to evaluate the performance of IC engines, use of machine elements like, belt drives, chain drives and gear drives. Students are introduced to the modern manufacturing technologies like CNC, 3D printing and applications of IIoT, Machine learning and robotics.

COURSE OBJECTIVES:

The objectives of this course are:

1. To develop the basic knowledge on energy resources, green energy concept, IC engines, turbines and refrigeration and air conditioning.
2. To incorporate the concept of different types of machine elements such as, gear drives, belt drives & chain drives.
3. To incorporate the concepts of mechatronics and robotics systems, modern manufacturing processes like CNC, additive manufacturing and digital manufacturing technology and its applications.
4. To provide a basic understanding role of computer science in mechanical engineering applications.
5. To provide the basic understanding of coding for mechanical engineering applications.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of energy resources to analyze real-world energy challenges and propose potential solutions and understanding of the concept of sustainability in the context of energy resources.	1, 2	1,2
CO2	Develop a comprehensive understanding of the working principles and application underlying prime movers and evaluate the performance of IC engines using python programming.	1, 2, 5	1,2
CO3	Gain a solid understanding of the fundamental principles refrigeration and air conditioning systems and develop a comprehensive understanding of working mechanical drives such as gears, belts, chains.	1	1,2
CO4	Identify the key elements of mechatronics system and interface sensors / transducer output with microprocessor for design or controlling of the system.	1, 5	1
CO5	Gain a comprehensive understanding of the principles and concepts underlying Industry 4.0, including, the Internet of Things (IoT), Machine Learning (AI), 3D printing and digital technologies.	1, 5	1,2,3
CO6	Understand the applications of robotics in various fields, such as manufacturing, agriculture, logistics, aerospace, etc and understand the concept of measurement system and control system used in robotics.	1	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3		√				
CO4		√	√			
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX:

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1											2	1	
CO2	2	2			1								2	1	
CO3	2												2	1	
CO4	2				1								2		
CO5	2				1								2	1	1
CO6	2												2	1	1
Average	2	1.5			1								2	1	1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Energy Resources: Types of energy resources: Green energy concept – Hydrogen energy; production using electrolysis process, advantages and disadvantages. Solar P-V system and wind energy.

IC Engines: Fuels and properties, classification of IC engines, parts and terminology, working of 4-stroke petrol engine, numerical on IP, BP, FP and Mechanical Efficiency, python programming for evaluation of engine performance.

Concept of electric and hybrid vehicles.

Gas Turbines: Open and closed cycle gas turbine, hydraulic turbines, Classification and working of Pelton wheel.

Refrigeration and Air Conditioning: Principle of Refrigeration system, working of domestic refrigerator (VCR) and window air conditioner.

Machine Elements: Belt drives, open and crossed belt drive, gear drives and chain drives, numerical on velocity ratio, python programming for computation of speed ratio.

Mechatronics Systems: Definition of mechatronics, components of mechatronics, basic Terminologies, Open loop and Closed loop control systems, microprocessor based control systems, static characteristics of sensor, working of capacitance sensor, eddy current sensor, hall effect sensor-Light sensors, optical encoders.

Introduction to Advanced Manufacturing and Industry 4.0 -Computer numerical control (CNC) machines, laser engraving, 3D printing, classification, applications, working of FDM, Introduction to Digital manufacturing- machine learning (ML) applications, Industrial Internet of Things (IIoT), Human Machine Interface.

Robotics and Automation: Need of Automated Guided Vehicle (Retrieval/storage system) in industries, applications of Robots, measurement system, open and closed loop control system. Adoption of logic gates in automation.

Self-Learning Component:

Hybrid vehicles, Engineering Materials, Need of Automated Guided Vehicle. Basics of numerical python and MAT Plot.

TEXT BOOKS:

1. K R Gopala Krishna, Sudheer Gopala Krishna and S C Sharma, “Elements of Mechanical Engineering”, Subhash Publishers, 13th Edition, 2015.
2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, 2000.
3. Manaranjan Pradhan and Dinesh Kumar U, “Machine Learning using Python”, Wiley Publishers, 1st Edition, 2019

REFERENCE BOOKS:
1. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, “The Elements of Workshop Technology - Vol I & II”, Media Promotors and publisher, 11th Edition, 2001.
2. William Bolton, “Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering”, Pearson, 2015.
3. K. K. Appukuttan, “Introduction to Mechatronics”, Oxford University Press, 2007.
4. Madhumathy P, M Vinoth Kumar, R. Umamaheswari “Machine Learning and IoT for Intelligent Systems and Smart Applications” CRC Press publisher, 2021.
5. John V. Guttag, “Introduction to Computation and Programming using Python”, MIT Press, 2016.

JOURNALS/MAGAZINES
1. International Journal of Refrigeration.
2. https://www.journals.elsevier.com/international-journal-of-hydrogen-energy
3.https://www.researchgate.net/publication/369942210_Fuel_Cell_Electric_Vehicle_Modeling_Using_HybridBatteryFuel_Cell_Vehicle_Modeling_Tool_HBFCMT.

SWAYAM/NPTEL/MOOCs:
1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering
2. https://www.my-mooc.com/en/categorie/mechanical-engineering

<table>
<tr><td>Course Title</td><td colspan="4">Advanced C programming and Applications</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24CI0201</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="3">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Review and build upon the fundamentals of C programming.
2. Define and use structures and unions to manage related data efficiently..
3. Handle file input and output operations using standard library functions.
4. Understand and implement various data structures for efficient programming.
5. Understand the working of the Unix platform for shell scripting.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Review and apply fundamental C concepts to learn advanced techniques.	1-3	1
CO2	Structure and manage code efficiently using structures, unions, and enumerations	1-5	1
CO3	Perform file operations such as opening, reading, writing, and closing files, and manage data stored in files.	1-3,5	2,3
CO4	Develop modular and robust C programs using standard library functions..	1-5	2,3
CO5	Write shell scripts on the Unix platform.	1-5	2,3
CO6	Understand the memory management system and to use relevant functions for effectively memory utilization	1-5,9	2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3										3		
CO2	1	3	2	2	2								3		
CO3	2	2	2		1									3	3
CO4	3	3	3	1	1									3	3
CO5	3	3	3	2	2										
CO6	3	3	3	2	2				3				3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

1. Review of C Fundamentals: Quick review of basic C programming concepts. Control and looping statements, arrays, strings and pointers.
2.Structures, Unions and Enumerations: Introduction to Structures, Defining and Using Structures, Arrays of structures, Pointers to Structures, Self-Referential Structures, Unions, Enumerations, Typedef.
3.File Input and Output: File Operations, reading from and Writing to Files, Binary File I/O, File Handling Functions.
4. Data Structures: Linked lists: singly, doubly, and circular linked lists, Stacks and queues: implementation and applications.
5. C Standard Library: Standard I/O Functions, Mathematical Functions, Utility Functions, Memory Management Functions.
6. Shell Scripting using C: Overview of UNIX operating system, UNIX architecture, Features of UNIX, Introduction to UNIX file system, Basic UNIX commands and utilities, UNIX shells: Bourne Shell, C Shell, Korn Shell, and Bash, Shell scripting basics, Variables, operators, and control structures in shell scripts, writing and executing shell scripts.
7: Dynamic Memory Allocation: Understanding Dynamic Memory Management, using malloc, calloc, realloc, and free and Memory allocation errors & Command-Line Arguments

Self Learning Component:

Evaluations of programming languages
Different programming languages and their applications in real world
Know more about most popular programming languages in the world by using : https://www.tiobe.com/tiobe-index/

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL SOFTWARE SERIES, 2005.
2. Herbert Schildt, “C: The Complete Reference”, 4th edition, TATA McGraw Hill, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, “Computer Concepts and C Programming: A Holistic Approach”, second edition, PHI,2008.
4. Yashavant Kanetkar, “Let us C” , BPB , 19th edition, 2022
5. Jon Bentley, “Programming Pearls”, 2nd edition, PEARSON,2002.

REFERENCE BOOKS:

1. Balaguruswamy,” Programming in ANSI C”, 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker,“ Computer Graphics C Version”, second edition, Pearson Education, 2004.
3. Jon Bentley, “Programming Pearls”, 2nd edition, PEARSON,2002.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294 (IEEE Journal/Magazine on IT Professional)
2. https://ieeexplore.ieee.org/document/1267572 (IEEE Computing in Science and Engineering)

SWAYAMNPTEL/MOOCs

1. https://online courses.nptel.ac.in/noc20_cs06/preview (Problem Solving through Programming in C)
2. https://www.edx.org/course/c-programming-getting-started (C Programming Getting started)
3. https://www.coursera.org/specializations/c-programming (Introduction to C programming)

<table>
<tr><td>Course Title</td><td colspan="4">Internet of Things</td><td colspan="2">Course Type</td><td colspan="2">HC(Integrated)</td></tr>
<tr><td>Course Code</td><td>B24EN0101</td><td>Credit</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>14</td><td>28</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

The Internet of Things (IoT) expands access to the world-wide web from computers, smartphones, and other typical devices to create a vast network of appliances, toys, apparel, and other goods that are capable of connecting to the Internet. This introductory course focuses on IoT architecture, Boards, sensors, actuators and communication protocols. The course is supported with hands on sessions that incorporates different types of sensors interfaced with IoT board to build IoT projects to solve real time problems. The case study of deployment of IoT in various applications are provided.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To understand the fundamentals of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interfacing of various sensors to IoT Boards, Arduino and Node MCU.
4. Discuss various applications of IoT.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Describe IoT architecture and Models of IOT	1,2,3,4,5	1,2
CO2	Identify and work on different IoT development boards	1,2,3,4,5	1,2
CO3	Identify communication technologies, protocols, and cloud services	1,2,3,4,5	1,2
CO4	Identify sensors & actuators and demonstrate the interfacing of sensors & actuators to IoT boards	1,2,3,4,5,9,10, 12	1,2
CO5	Interpret various Applications of IoT	1,2,3,4,5,6,9,10,12	1,2,3
CO6	Develop simple IoT projects and modules	1,2,3,4,5,9,10,11,12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√				
CO3	√	√	√			
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1								3	3	
CO2	2	3	1	1	1								3	3	
CO3	3	2	1	1	2								2	2	
CO4	3	3	3	2	2				2	1		2	2	2	
CO5	3	2	2	1	2	2			2	1		2	2	2	1
CO6	3	2	2	1	2				2	2	2	2	2	2	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

IoT Basics and Arduino UNO Board

Introduction to IoT and its working, IoT Architecture, Models of IOT, Characteristics of IoT, Merits, demerits, futures scope and challenges of IoT, IOT Echo system, Arduino UNO board, memories, microcontroller, Basic programming of Arduino UNO board: Numeric data types, text data types, Array data types, Digital input output functions, Communication Technologies: Bluetooth, ZigBee, Wi-Fi, Cellular

IoT Enabling Technologies and Applications

IoT Development Boards: Node MCU, Raspberry Pi; Sensors and Actuators: Temperature Sensor, PIR Sensor, Ultrasonic senor, LDR, Applications of IoT, Protocols: HTTP, MQTT, CoAP; IoT Cloud Platforms: Arduino Cloud, Thing Speak, Blink Cloud

Experiments:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
	Arduino UNO		
1	Experiment-01 Introduction to Arduino Board & getting started with Arduino IDE software. Write a program to blink an LED: a) Infinite number of times with ON & OFF duration of 1 sec b) Only 3 times with ON and OFF duration 2 sec	Hardware & software for Arduino UNO Arduino UNO Board Arduino IDE LED	Identifications of various parts of Arduino UNO and Coding
2	Experiment-02 a) Write a program to increase and decrease the brightness of LED. b) Write a program to control the brightness of LED using Potentiometer.	Arduino UNO Arduino IDE LED Potentiometer	Interface of Potentiometer
3	Experiment-03 a) Write a program to interface LDR to Arduino board and display the voltage across LDR on serial monitor. b) Write a program to control the brightness of LED based on the intensity of light on LDR.	Arduino UNO Arduino IDE LED LDR	Interface LDR sensor
4	Experiment-04 a) Write a program to interface temperature sensor and display the values on the serial monitor. b) Write a program to display the range of temperature on LCD.	Arduino UNO Arduino IDE LCD Temperature sensor	Interface Temperature sensor
5	Experiment-05 Write a program to interface ultrasonic sensor and display the distance from an object.	Arduino UNO Arduino IDE Ultrasonic sensor	Interface Ultrasonic sensor
	NODU MCU		
8	Experiment-06 Introduction to NODE MCU and Write a Program for 2-BIT COUNTER using Node MCU.	Hardware & software for NODE MCU NODE MCU Board Two LED’s	Identifications of various parts of NODE MCU and Coding
9	Experiment-07	NODE MCU	Interface PIR sensor

	Write a program to interface motion sensor and display its status using LED. If motion is detected, turn on LED otherwise keeps the LED off.	LED PIR sensor	
10	Experiment-08 Write a program to interface Single LED blinking using Node MCU and Bluetooth module.	Node MCU Bluetooth module LED	Connection of Bluetooth to NODE MCU
11	Experiment-09 Write a program to control the status of LED using relay.	Node MCU Bluetooth module LED	Control of LED through Relay
12	Experiment-10 Write a program to interface temperature sensor and display the values on Web Page/Cloud.	Node MCU Temperature Sensor LED Cloud Service	Connect to cloud and display the values

TEXTBOOKS:

1. Vijay Madisetti, Arshdeep Bahga , “Internet of Things: A Hands-On- Approach “ Second edition 2014, ISBN: 978 0996025515.

REFERENCE BOOKS:

2. Raj Kamal,” Internet of Things: Architecture & design Principle”, McGraw Hill Education 2017.

Additional Material:

1. https://www.coursera.org/learn/iot
2. https://www.coursera.org/learn/interface-with-arduino
3. https://www.youtube.com/watch?v=APH6Nrar27w&list=PLYwpaL_SFmcB8fDd64B8SkJiPpEIzpCzC
4. https://www.youtube.com/watch?v=NSUj_NMV5t0&list=PLuAADu3OvBt4SUxlYPu_xJogSmVfSLZF0

Course Title	Physics for Computer science Lab				Course Type		FC	
Course Code	B24AS0208	Credits	1		Class		II Semester	
	LTP	Credits	Contact Hours	Workload	Total Number of classes per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	1	2	2	0	28	25	25

COURSE OVERVIEW:

Engineering Physics is very important and necessary basic subject for all branches of engineering students. It provides the fundamental knowledge of basic principles of Physics which is required for basic foundation in engineering education irrespective of branch. This course introduces the experimental concepts of Physics and its applications to Computer Science Engineering courses by emphasizing the following concepts: electrical properties, dielectrics, semiconductors, LASERs, and optical properties. This course provides a basic understanding of the working of different electronic components. The course also emphasizes simulating the working of some electronic components.

COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Demonstrate the principles covered in your study material in physics.
2. Provide familiarity with apparatus and enable them to handle the instruments and apparatus with purpose.
3. Identify the process to study conditions for a given experiment.
4. Develop an attitude of perfection in practical tasks.
5. Simulate the working of different electronic components using mobile or a computer.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Constructing simple circuits and performing experiments to study voltage-current response.	1, 2,3 4	1,2,3
CO2	Determination of unknown physical parameters related to LASERs	1,2, 3,5	2, 3
CO3	Determination of unknown physical parameters related to optical fibers.	2,3, 4, 8,	1, 2, 3
C04	Determine the dielectric constant of the material.	2,3, 4,8,	1, 2, 3
CO5	Simulating the experimental data of physical experiments	1 to 5	1, 2, 3
CO6	Simulate the working of electronic circuits	1 to 5, 8 to 10	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1						
CO2						
CO3						
C04						
CO5						
CO6						

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3							3	3					1
CO2	3	3							3	3					2
CO3	3	2							3	3					1
CO4	3	2							3	3					1
CO5	3	2							3	3					2
CO6	3	2							3	3					1

List of Experiments

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Light-dependent characteristics of a photosensor.	Photodiode, Ammeters, and voltmeters.	Circuit construction, Perform, and plotting of data using Matlab/origin
2	Determination of wavelength of IR LEDs and energy gap in applications to remote controllers.	LEDs, AC source, and voltmeters.	Circuit construction, Perform, and plotting of data using Mat lab/origin
3	Simulation of experimental data using Origin software	Origin software	Simulated graphs
4	Determination of numerical aperture and acceptance angle to launch the optical power into the optical fiber for digital communication.	LASER. Optical fiber light source, DC supply	Experimental setup, plotting of data using Matlab/origin
5.	Determination of the attenuation coefficient of the given optical fiber for long-distance communication.	LASER. Optical fibers light source, DC supply	Experimental setup, plotting of data using Matlab/origin

6	Determination of wavelength of LASER for LASER printing and digital communications.	LASER. Optical fiber light source, DC supply	Experimental setup, plotting of data using Matlab/origin
7	Verification of splicing loss experimental for optical fiber.	Diode laser, digital dc micrometer two OFC (1.5m &2.5m), optical sensor	Circuit construction, Perform, and plotting of data
8	Determination of dielectric constant using charging and discharging of capacitor	Capacitor, resistor, voltmeters	Circuit construction, Perform, and plotting of data
9	Study of motion using spreadsheets	Simulation software	Circuit construction, Perform, and plotting of data
10	PhET interactive simulations (Projectile motion, wave-particle dualism).	Simulation software	Circuit construction, Perform, and plotting of data

Part B: Demo and Simulation

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Generation of ultrasonic waves by piezoelectric transducers and its velocity determination in liquid for the Haptics applications.	piezoelectric transducers	To understand the concept of Haptics
2	Demonstration of superposition of waves of monochromatic light.	Oscillators and CRO	Interference of waves to understand the quantum superposition
Experiments for the mathematical model			
3	Bending of a single cantilever, its mathematical model. Time-period calculation of simple pendulum, its mathematical model.	Every circuit (android app) Tina (Online simulator)	Visualize, simulate, and analyze

TEXTBOOKS:

1. M.N. Avadhanulu and P.G. Kshirsagar, “A Textbook of Engineering Physics”, S. Chand & Company Ltd, New Delhi, 10thEd, 2008.
2. Gaur and Gupta, “Engineering Physics”,Dhanpat Rai Publications, 6thEd, 2017.
3. S.P. Singh, “Advanced Practical Physics Vol.- I”, Pragati Prakashan, 15th Ed, 2017.
4. G.L.Souires, “Practical Physics”, Cambridge University, UK, 4th Ed,2001.

Reference Books:

1. Arthur Beiser, “Concepts of Modern Physics”, Tata McGraw Hill Edu Pvt. Ltd- New Delhi, 6thEd, 2006.
2. S O Pillai, “Solid State Physics”, New Age International Publishers, 8thEd, 2018.
3. S M Sze, Physics of Semiconductor Devices, Wiley, 3rd Ed, 2004.
4. Walter Fox Smith, “Experimental Physics”-Principles and Practice for the Laboratory, CRC Press, Taylor & Francis group, 1stEd, 2020.

Course Title	**Advanced C programming and Applications Lab**				**Course Type**		**HC**	
Course Code	**B24CI0202**	**Credits**	**1**		**Class**		**II Semester**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture	**-**	**-**	**-**				
	Tutorial	**-**	**-**	**-**	**Theory**	**Practical**	**IA**	**SEE**
	Practice	**1**	**2**	**2**				
	Total	**1**	**2**	**2**	**-**	**28**	**25**	**25**

COURSE OVERVIEW:

Pseudocode, Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure-oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

1. Define and use structures & Unions to group and manage related data efficiently.
2. Perform file input and output operations using standard library functions.
3. Understand structuring of data using data structures for efficient programming
4. To understand working of Unix platform for shell scripting.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	To review C fundamentals to learn advanced concepts	1-3	1
CO2	To make the code structured & easier to read and maintain, using concept of structures, unions & integral constants	1-5	1
CO3	Perform file operations such as opening, reading, writing, and closing files. Utilize file handling	1-3,5	2,3
CO4	Develop the ability to write efficient, modular, and robust C programs using standard C library functions.	1-5	2,3
CO5	Learn to write shell scripts on Unix platform.	1-5	2,3
CO6	Interface C code from other programing languages.	1-5,9	2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	**Understand** (L2)	**Apply** (L3)	**Analyze** (L4)	**Evaluate** (L5)	**Create** (L6)
CO1				✓		
CO2			✓			

CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**	**3**										**3**		
CO2	**1**	**3**	**2**	**2**	**2**								**3**		
CO3	**2**	**2**	**2**		**1**									**3**	**3**
CO4	**3**	**3**	**3**	**1**	**1**									**3**	**3**
CO5	**3**	**3**	**3**	**2**	**2**										
CO6	**3**	**3**	**3**	**2**	**2**				**3**				**3**	**3**	**2**

Note:1-Low,2-Medium,3-High

Sl. No	**Program**
1	Design and Develop C program to perform following operation using string. Concatenation of two strings Length of a string
2	Program to count the total number of vowels and consonants in a string.
3	Write a C program to define a structure named Em with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth. Defines a structure to hold employee information (name, ID, salary). b. Allows the user to input details for multiple employees. c. Displays the entered employee details.
4	Write a C program to define a structure named Student with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth.
5	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX). Push an Element on to Stack Pop an Element from Stack Demonstrate Overflow and Underflow situations on Stack Display the status of Stack Exit

	Support the program with appropriate functions for each of the above operations
6	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) Insert an Element on to Circular QUEUE Delete an Element from Circular QUEUE Demonstrate Overflow and Underflow situations on Circular QUEUE Display the status of Circular QUEUE Exit Support the program with appropriate functions for each of the above operations
7	Write a C program for the following file operations: Program to create and write data to a text file. Program to read data from a text file and display it on the console.
8	Design and demonstrate the use of file handling functions like fopen(), fclose(), fgets(), fputs(), fread(), and fwrite().
9	Create, delete, and manage files and directories using touch, rm, mkdir, rmdir, and mv.
10	Write a script to check if a number is positive, negative, or zero.

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, “C: The Complete Reference”, 4th edition, TATA McGraw Hill, 2000.
4. B.S. Anami, S.A. Angadi and S. S. Manvi, “Computer Concepts and C Programming: A
5. Holistic Approach”, second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy,” Programming in ANSI C”, 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker,“ Computer Graphics C Version”, second edition, Pearson Education, 2004.
3. NPTEL Courses- www.swayam.go

<table>
<tr><td>Course Title</td><td colspan="4">Innovation & Entrepreneurship</td><td colspan="2">Course Type</td><td colspan="2">FC Integrated</td></tr>
<tr><td>Course Code</td><td>B24ME0102</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>14</td><td>28</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW

NEN Ignite is an entrepreneurship program based on experiential learning that aims to support startups' founders through a structured pathway from Idea Discovery to Pitch Deck.

COURSE OBJECTIVES

The objectives of this course are to:

1. Discover an entrepreneurial opportunity
2. Articulate a compelling value proposition
3. Build a sustainable business model and business plan
4. Create and validate an MVP with potential customers
5. Select an appropriate Go-to-Market Strategy
6. Pitch the business idea to different stakeholders

COURSE OUTCOMES (CO'S)

On successful completion of this course; the student shall be able to:

CO	Course Outcomes	POs	PSOs
CO1	Identify the different aspects that can impact their business	3,9,10,11,12	1
CO2	Acquire in-depth knowledge about tools to build any business idea	3,9,10,11,12	1
CO3	Acquire in-depth knowledge about the different growth tools to grow their business.	3,9,10,11,12	1
CO4	Create a financial plan for their business	3,9,10,11,12	1
CO5	Create a pitch deck for their business and present it to different stakeholders	3,9,10,11,12	1

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1			**2**						**2**	**2**	**3**	**2**	**2**		
CO2			**2**						**2**	**2**	**3**	**2**	**2**		
CO3			**2**						**2**	**2**	**3**	**2**	**2**		
CO4			**2**						**2**	**2**	**3**	**2**	**2**		
CO5			**2**						**2**	**2**	**3**	**2**	**2**		

COURSE CONTENT

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges. Taking product or service ideas to creating value: Why should one choose to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship.

Orientation for WE Ignite program, Ice Breaking session, self-work Instructions and timelines Platform Demo Introduction to Ignite program flow and milestones , Introduction to Entrepreneurship and Human centred Approach to Design Thinking , Are you enterprising?. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving

100 Rupee Venture; Debrief of Group Activity- Presentation and Sharing Learning Experience

Entrepreneurial Opportunities: Opportunities. Discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering. Problem Identification and Opportunity Discovery. Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation
Customer and Markets : Customer Discovery: Exploring Customer Personas & Market Estimation for your Ideas, Create a compelling value proposition & Competitive Advantage
Build your MVP : Building a MVP that customers Love
Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas, Introduction to lean start-ups, Business Pitching
Business Model: Developing strong business models Create and present your Lean Canvas
Financial Feasibility: Introduction to Business plan and its components; Basics of Finance.
Institutional Support for Entrepreneurship:
Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs
Go To market Strategy: Getting products to market: Channels & Strategies; Managing growth and Targeting Scale: Understand the Unit economics for your venture; Funding Strategy: Securing funding for your Startup and Preparing for pitch.

TEXT BOOK:

1.Wadhwani Foundation Curriculum K. Ramachandran, “Entrepreneurship Development”, Tata Mc. Graw Hill, 2008
2.Sangeeta Sharma, “Entrepreneurship Development” PHI Publications, 2016

REFERENCE BOOKS:

1.Baringer and Ireland, “Entrepreneurship”, Pearson, 11th Edition, 2020.
2.Drucker F Peter: “Innovation and Entrepreneurship”, 1985.Heinemann, London.
3.Doanld F Kuratko & Richard M Hodgeth, “Entrepreneurship in the New Millennium”, India Edition - South-Western,
4.Cengage Learning Entrepreneurship –by Robert D. Hisrich (Edition-9)
5.Entrepreneurship- Theory, Process & Practice –by Kuratko & Hodgetts, Thompson South-Western Publication
6.Technology Entrepreneurship Taking Innovation to the Marketplace – by Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, Elsevier

JOURNALS/MAGAZINES

1. International Small Business Journal: https://journals.sagepub.com/home/isb
2. Journal of Development Entrepreneurship: https://www.worldscientific.com/worldscinet/jde

SWAYAM/NPTEL/MOOCs:

1.Entrepreneurship: https://nptel.ac.in/courses/110/106/110106141/

<table>
<tr><td>Course Title</td><td colspan="4">Communicative English</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td>B24AH0103</td><td>Credit</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td></td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

Today many companies are working on international projects where English is increasingly used by engineers across the world to communicate with all groups involved. This course is designed for entry-level Engineering and Technology curriculum enabling the students to learn, acquire, and apply for their learning and career. The course is aimed at providing effective skills for promoting communication skills through English. Hence in the present scenario Engineering English course is to be fully tailored to the specific needs of engineers. The outcome of this course contains a refined level of English proficiency by acquiring all four skills, listening, speaking, reading, and writing to prepare them for global readiness.

COURSE OBJECTIVES:

The objectives of this course are :

To develop the communicative competence of learners

To utilize language effectively in academic contexts

To change various listening strategies to comprehend various types of audio materials like lectures, discussions, videos, etc.

To build on students' interest in English language skills by engaging them in listening, speaking, and grammar learning activities that are relevant to authentic contexts.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyse Listening, Comprehend and Correspond with others in various contexts	10	
CO2	Apply proper communication modules to Speak legibly and fluently under various lifetime situations	10	
CO3	Analyse the meaning and language while reading a variety of writings and technical texts	10	
CO4	Demonstrate products and processes and explain their uses and purposes clearly and accurately	10	
CO5	Make use of various communicative skills in precise and efficient ways in technological contexts	10	
CO6	Create situational conversations and technical writing styles for interpersonal and effective communication	10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		
CO2			√			
CO3				√		
CO4		√				
CO5			√			
CO6						√

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										2					
CO2										2					
CO3										2					
CO4										2					
CO5										2					
CO6										3					

Note:1-Low,2-Medium,3-High

COURSE CONTENTS

Fundamentals of Communication

Listening: Listening for general information-specific details- conversation: Introduction to classmates - Audio /video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Listening to TV News and guest Lecturers.

Speaking: Pronunciation Common Vocabulary – Technical Vocabulary – Answering Peer Questions – Conversation with Teacher, making telephone calls Introduction; Introducing a friend

Reading: News magazines, Reading for unfamiliar words, Variety of News Items

Writing: Word formation – Auxiliary verbs – Modal Verbs – Sentence Types – Affirmative, Negative, Interrogative, Concord – Dialogue Writing, Paragraph writing Narration and Summation

Listening: Listening to Peer Conversations – Brief Speeches – Listening for Specific Information – Recap of Speeches, Listening to podcasts, anecdotes/stories / event narration; documentaries and interviews with celebrities.

Speaking: Telephonic enquiries official/formal enquiries, narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations - describing experiences and feelings- engaging in small talk- describing requirements and abilities.
Reading: Technical Essays – Identifying Sentence Types – Classifying the verb patterns
Writing: Tenses – Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous – Voice – Active & Passive, email writing

Description of A Process / Product

Listening: Listen to product and process descriptions; a classroom lecture; and advertisements about products. Digital Videos for World Information
Speaking: Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.
Reading: Coherence, Development of Thoughts
Writing: Tenses – Simple Past, Past Progressive, Past Perfect, Past perfect continuous – Impersonal Passive-Narrating the past events, Permission Letter for Industrial Visit/Functions held

Classification and Recommendations

Listening: Listening to TED Talks; Listening to Dialects of English – British & American Regional Listening to achievers, eminent personalities
Speaking: Role Plays, Extempore, Responding to specific questions
Reading: Texts on self-confidence, motivation, success path, Comprehensive passages, Reading for specific points
Writing: Tenses – Simple Future, Future progressive, Future Perfect, Future Perfect continuous – Definition – Phrases of Reason – Cause & Effect, Report writing

Self Learning Component: Online Activities on LSRW Skills

Teaching Pedagogy: MALL, CALL, Online, Blended Teaching, Flipped Classroom

TEXT BOOKS:

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCE BOOKS:

1. Murphy, Raymond English Grammar in Use with Answers: Reference and Practice for Intermediate Students, Cambridge: CUP, 2004
2. Thomson, A.J. and Martinet, A.V. A Practical English Grammar, OUP, New Delhi: 1986
3. Anne Laws, —Writing Skills, Orient Black Swan, Hyderabad, 2011
4. Green, David. Contemporary English Grammar Structures and Composition. MacMillan, 2010.
5. Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 2012.
6. Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.
7. Rizvi, M. Ashraf. Effective Technical Communication. Tata McGraw-Hill, 2005.
8. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
9. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.

Course Title	**Engineering Exploration**				**Course Type**		**FC**	
Course Code	**B24CIET01**	**Credits**	**1**		**Class**		**II semester**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**1**	**1**	**1**				
	Tutorial	**0**	**-**	**-**				
	Practice	**0**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**1**	**1**	**1**	**14**		**25**	**25**

COURSE OVERVIEW:

This course provides a comprehensive introduction to the field of engineering, aimed at equipping students with the foundational knowledge and skills necessary to pursue a career in this dynamic and impactful discipline. The curriculum is designed to cover a broad spectrum of topics, from the historical and contemporary contributions of engineering to the principles and practices that define the profession today, with a particular emphasis on the Indian context.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Introduce in the field of engineering, emphasizing the role of engineers as problem solvers and innovators.
2. Familiarize with the global and Indian engineering industries, highlighting various career opportunities.
3. Develop an engineering mindset by analyzing the design and functioning of common engineering artifacts.
4. Enhance ability to work effectively in multidisciplinary teams, utilizing problem-solving skills, project management concepts, and effective communication of engineering ideas through written reports and presentations.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Explain what engineering is, the role of an engineer as a problem solver and appreciate the history and impact of significant engineering achievements especially in the Indian context.	1,2,12	1
CO2	Be familiar with the global and Indian engineering industry and the various career opportunities it offers.	1,2	1
CO3	Demonstrate Engineering Mindset by analyzing design and working of common engineering artefacts and Gain practical insights through case studies, product dissection, and industry interactions.	1,4	2
CO4	Apply the engineering design process and principles to identify needs, define problems, and develop solutions	2,3	1
CO5	Demonstrate the ability to work effectively in multidisciplinary teams, Use problem Solving Skills, apply project management concepts, and communicate engineering ideas through written reports and presentations.	5,9,10	3
CO6	Recognize the importance of professional ethics, sustainability, and the societal impact of engineering solutions, and incorporate these considerations into the design process.	6,7,8,12	3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√				
CO3		√				
CO4			√			
CO5		√				
CO6				√		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										2	3		
CO2	3	3											3		
CO3	3		3											3	
CO4		3	3										3		
CO5					3				3	3					3
CO6						2	3	3				3			3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Definition of engineering, its scope, and various disciplines, Understanding the engineer's role in identifying, defining, and solving problems, Examples of engineering problem-solving in everyday life and industry.

Overview of engineering through different historical periods, Key milestones and developments in engineering practices, Case studies on significant engineering achievements and their societal impacts, Overview of historical engineering achievements in India (e.g., ancient water management systems, Indus Valley civilization), Modern engineering marvels in India (e.g., ISRO's achievements, infrastructure projects).

Present-day engineering issues (e.g., sustainability, climate change, urbanization), Role of engineers in addressing these challenges, Exploration of emerging fields (e.g., artificial intelligence, biotechnology, renewable energy), Career opportunities global and Indian engineering industry.

Definition and characteristics of an engineering mindset, Importance of critical thinking, problem-solving, and creativity in engineering, Design thinking process, Application of design principles in engineering artefacts, Common engineering product for its design principles and functionality.

Case Study Analysis: Successful Engineering Designs, Examination of case studies (e.g., bridges, consumer electronics, medical devices), Factors contributing to the success of these designs, Product Dissection, Techniques and importance of product dissection in understanding engineering principles, Hands-on dissection of a chosen engineering product (Mobile or Two Wheller or Laptop).

Importance of Multidisciplinary Teams in Engineering Projects, Team Dynamics and Collaboration, Engineering Problem-Solving Process, Application of problem-solving frameworks (e.g., TRIZ, Six Sigma), Project Management Concepts in Engineering, Visual Communication in Engineering, diagrams, graphs, and visual aids in technical reports and presentations, Tools for creating effective visual representations of engineering concepts.

Improvements for an existing engineering artefact, considering ethical and sustainability aspects.

TEXTBOOKS:

1. "Engineering Fundamentals: An Introduction to Engineering" by Saeed Moaveni
2. "Introduction to Engineering" by Paul H. Wright
3. "The Engineering Design Process" by Atila Ertas and Jesse C. Jones
4. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger
5. Web Based Resources and E-books:
6. "Engineering Your Future: A Brief Introduction to Engineering" by William Oakes, Les Leone, and Craig Gunn

<table>
<tr><td>Course Title</td><td colspan="4">Emerging Technologies on Full Stack Web Development</td><td colspan="2">Course Type</td><td colspan="2">ETC</td></tr>
<tr><td>Course Code</td><td>B24CSET02</td><td>Credit</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td></td><td></td><td></td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>1</td><td>1</td><td>1</td><td>14</td><td>0</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

The basics of Web application tools such as HTML, and CSS are introduced. The course also provides knowledge about advanced research topics such as JavaScript, and PHP.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the basic concepts of HTML code.
2. Illustrate the use of Cascading Style Sheets in web pages.
3. Demonstrate the use of Java Scripts in real world applications.
4. Describe the usage of PHP in web development.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Experiment with various HTML tags to create a web page for real world applications.	1 to 5 , 9,10,12	1
CO2	Apply Cascading Style Sheetsto design a web page for real world applications.	1 to 5 , 9,10,12	1
CO3	Develop client-side environment using JavaScripts for Web based applications.	1 to 5 , 9,10,12	2,3
CO4	Build a server-side environment using PHP for Web based application	1 to 5 , 9,10,12	2,3
CO5	Develop real time web applications.	1 to 5 , 9,10,12	1,3
O6	Make use of front end technologies and server side scripting languages to develop web applications.	1 to 5 , 9,10,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			√			
CO2			√			
CO3			√			
CO4			√			

CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX:

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**1**	**3**	**3**	**2**				**3**	**3**		**3**	**3**		
CO2	**3**	**2**	**2**	**3**	**2**				**3**	**3**		**3**	**3**		
CO3	**3**	**2**	**3**	**3**	**2**				**3**	**3**		**3**		**3**	**3**
CO4	**3**	**2**	**3**	**3**	**2**				**3**	**3**		**2**		**3**	**3**
CO5	**3**	**3**	**2**	**2**	**3**				**3**	**3**		**3**	**3**		**3**
CO6	**3**	**2**	**3**	**3**	**1**				**3**	**3**		**3**		**3**	**3**

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

Introduction to HTML: HTML Syntax, Semantic Mark-up, Structure of HTML Documents, HTML Elements, HTML Semantic Structure Elements, HTML Web Storage. HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form concepts.

Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, and The Cascade: How Styles Interact, CSS Text Styling. Types Of CSS Layout with Examples.

Introduction to JavaScript: JavaScript: Client-Side Scripting, JavaScript’s History and Uses, JavaScript Control statements, Functions, JavaScript Objects, Constructors, Validation Example for HTML form.

Introduction to PHP: Installation of XAMPP/WAMP Server, Introduction to PHP, data types, conditional statements, looping statements, functions, Arrays and Superglobals, Working with Databases, MySQL, Database APIs,. Accessing MySQL in PHP.

TEXT BOOKS:

1.Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development”, Pearson Education India, 1st Edition, 2016. 2.Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 1st Edition, 2006. 3.Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2007.

REFERENCE BOOKS:

1. Robin Nixon, “Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5”, O’Reilly Publications, 4th Edition, 2015.
2. Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Pearson Education, 5th Edition 2016.
3. Nicholas C Zakas, “Professional JavaScript for Web Developers”, Wrox/Wiley India, 3rd Edition 2012.
4. David Sawyer Mcfarland, “JavaScript & jQuery: The Missing Manual”, O’Reilly/Shroff Publishers & Distributors Pvt Ltd, 1st Edition, 2014
5. Zak Ruvalcaba Anne Boehm, “Murach's HTML5 and CSS3”, Murachs/Shroff Publishers & Distributors Pvt Ltd, 3rd Edition, 2016.
6. Gerardus Blokdyk, “Representational State Transfer: Practical Integration”, CreateSpace Independent Publishing Platform, 1st Edition, 2018 7. Michael Fitzgerald, ‘Learning Ruby”, O’Reilly, 1st Edition, 2007

JOURNALS/MAGAZINES:

1. https://www.inderscience.com/jhome.php?jcode=ijwet
2. http://stmjournals.com/Journal-of-Web-Engineering-and-Technology.html

3. https://www.scimagojr.com/journalsearch.php?q=15657&tip=sid
4. https://www.smashingmagazine.com/
5. https://www.computer.org/publications/computing-edge

SWAYAM/NPTEL/MOOCs:

1. Coursera - Web Design: Wireframes to Prototypes
2. Coursera – Web Application Technologies and Django
3. https://nptel.ac.in/courses/106/105/106105084/
4. https://www.edx.org/learn/web-development .

III SEMESTER

III Semester

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern				Contact Hours/ Week	Examination			AICTE Course category
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B24	Discrete Mathematics and Graph Theory	FC	3	0	0	3	3	50	50	100	BSC
2	B24EF0301	Data Structures	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0301	Object Oriented Programming with Java	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0302	Digital Logic and Design	HC	3	0	0	3	3	50	50	100	PCC
5	B24EIS31X	Professional –Elective-1	SC	3	0	0	3	3	50	50	100	PEC
6	B24EF0304	Data Structures Lab Using C	HC	0	0	1	1	2	25	25	50	PCC
7	B24EI0303	Object Oriented Programming with Java Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0304	Digital Logic and Design Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0305	Course based Project (SDC)	SDC	0	0	1	1	2	25	25	50	Proj
10	B24CI0309	Introduction to Design Thinking	HC	1	0	1	2	3	50	50	100	BEC
11	B24	Technical Documentation	FC	1	0	0	1	1	25	25	50	HSMC
12	B24	Indian Constitution and cyber law	MC	1	0	0	0	1				HSMC
13	B24EF0308	AEC-1(Ability Enhancement Course) (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				18	0	6	23	30	450	450	900	

TOTAL SEMESTER CREDITS	23
TOTAL CUMULATIVE CREDITS	64
TOTAL CONTACT HOURS	30
TOTAL MARKS	900

<table>
<tr><td>Course Title</td><td colspan="4">Discrete Mathematics and Graph Theory</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td></td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Discrete Mathematics is the study of discrete objects. Discrete Mathematics is used to develop our ability to understand and create mathematical arguments and also used to provide the mathematical foundation for advanced mathematics and computer science courses.

Graphs (abstract networks) are among the simplest mathematical structures, which are used in most of the areas of Computer Science to solve the complex problems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain mathematical arguments using logical connectives and quantifiers.
2. Illustrate the operation on discrete structures such as sets, relations and functions.
3. Describe the theory and application of graphs, fundamental theorems and their proofs.
4. Demonstrate the use of graphs to model many types of relations and processes in physical, biological. Social and information system.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives	1 ,2,3	2
CO2	Student should learn about predicate logic in mathematical statements. Student should understand the concept of logical inference and be able identify valid and invalid arguments.	1 ,2,3	2
CO3	To understand and to distinguish different types of relations and functions.	1 ,2,3	2
CO4	Student should develop the ability to use logical reasoning to prove properties of relations and functions.	1 ,2,3	2
CO5	Illustrate the concept of isomorphic graphs and isomorphism invariant properties of graphs	1 ,2,3	2
CO6	Develop a model using advanced concepts of graph for real world applications	1 ,2,3	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4		√				
CO5		√				
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1											3	
CO2	3	2	3											3	
CO3	3	1	2											3	
CO4	3	2	3											3	
CO5	3	2	2											3	
CO6	3	2	2											3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Mathematical Logic: Propositions, Logical Connectives and truth tables (Illustrative Examples), Logical equivalence, Laws of logic, Duality, NAND and NOR connectives (Circuits), Converse, Inverse and Contrapositive, Rules of Inference, Quantifier, Logical implication involving quantifiers.
Applications: Design of computing machines, artificial intelligence, definition of data structures for programming languages etc

Relations and Functions : Cartesian product of sets (Illustrative Examples), Matrices and Digraph of the relations, Properties of relations, Equivalence relations, Partial ordered relations, Posets, Hasse diagrams, Extremal elements in posets, Types of Functions, The pigeon hole principle, Sterling number of second kind.
Application: Data structures, Class-based object-oriented systems, Machine learning, Databases, Pattern matching, and by extension, compilers

Introduction to graph theory: Konigsberg's bridge problems, Utilities problem, Seating Problem, Graphs, Representation of Graphs. Directed graphs, Incidence, Adjacency, Degree, In degree, Out degree, Regular graphs, Complete graphs, Null Graph, Bipartite Graphs, Isomorphism, Directed Graphs, Sub graphs, Walk, Trail, Path, Circuit, Cycle, Connected and disconnected graphs.

Applications: Finding shortest routes in car navigation systems, Search engines use ranking algorithms based on graph theory, Analysis of social networks, Compilers use coloring algorithms to assign registers to variables, Path planning in robotics.

Euler and Hamiltonian graphs and Graph coloring: Definition of Euler Graphs, Hamiltonian Graphs, Standard Theorems on Euler and Hamiltonian graphs, planar graph, Dual of planar graphs, Graph coloring, Chromatic polynomial, Five Color Theorem, Matching, , Cut set, Network flow, and its applications.
Applications: Graph coloring especially used various in research areas of science such data mining, image segmentation, clustering, image capturing, networking etc.

TEXT BOOKS:

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, 2014.
2. Nasingh Deo, "Graph Theory with Applications to Engineering Computer Science", Prentice-Hall, 2014.

REFERENCE BOOKS:

1. Keneth H Rosen, "Discrete Mathematics and its applications", 5th Edition,, Tata McGraw Hill, 2014.
2. C L Liu, "Elements of Discrete Mathematics", 4th edition, Tata MacGraw Hill 2014.
3. Thomas Khoshy, "Discrete Mathematics with applications", Elsvier, 2012.
4. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Asia, 2015.
5. Frank Harary, "Graph Theory", Norosa, 2013.
6. J. A. Bondy and V. S. R. Murthy,"Graph Theory with Applications", Macmillan, London, 2013.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/discrete-mathematics
2. http://www.math.iit.edu/~kaul/Journals.html
3. https://www.siam.org/publications/journals/siam-journal-on-discrete-mathematics-sidma
4. https://onlinelibrary.wiley.com/journal/10970118
5. https://iopscience.iop.org/article/10.1088/1742-6596/1175/1/012069/meta
6. https://iopscience.iop.org/article/10.1088/1742-6596/1188/1/012065/meta
7. https://www.worldscientific.com/worldscinet/jml
8. https://www.scimagojr.com/journalsearch.php?q=12000154480&tip=sid

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/107/111107058/
2. https://nptel.ac.in/courses/106/103/106103205/
3. https://onlinecourses.swayam2.ac.in/cec20_ma02/preview
4. https://onlinecourses.nptel.ac.in/noc20_ma05/preview
5. https://onlinecourses.swayam2.ac.in/cec20_ma03/preview
6. https://www.coursera.org/learn/graphs

<table>
<tr><td>Course Title</td><td colspan="4">Data Structures</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0301</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes
Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>--</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course is designed for undergraduate students to develop a strong foundation in the principles and practices of data structures, a fundamental aspect of computer science. This course provides an in-depth understanding of various data structures and their applications, essential for effective algorithm design and software development. By the end of this course, students will have a solid understanding of various data structures, their implementation, and applications. They will be equipped with the skills to design efficient algorithms and optimize software performance through effective use of data structures. The course combines theoretical concepts with practical coding exercises to ensure comprehensive learning and application.

COURSE OBJECTIVE (s):

The objectives of this course are to:

1. Master the implementation and manipulation of fundamental data structures in C.
2. Develop proficiency in using pointers and structures for dynamic memory management.
3. Design and analyze algorithms to solve computational problems efficiently.
4. Understand and implement advanced data structures like AVL trees and heaps.
5. Enhance problem-solving skills by applying appropriate data structures to real-world problems.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Demonstrate proficiency in using pointers and structures for dynamic memory management and manipulation.	1 to 5,9,10,12	1
CO2	Implement and analyze various linked lists, stacks, and queues for efficient data organization.	1 to 5, 9,10,12	1,2
CO3	Apply different data structures to design and optimize algorithms for solving complex problems.	1 to 5, 9,10,12	1,2
CO4	Construct and traverse binary trees, AVL trees, and other advanced tree structures to manage hierarchical data.	1 to 5, 9,10,12	1,2
CO5	Utilize graphs and heaps in solving real-world problems involving network and priority management.	1 to 5, 9,10,12	1,2,3
CO6	Compare and contrast different data structures and algorithms to choose the most appropriate one for specific applications.	1 to 5, 9,10,12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate(L5)	Create(L6)
CO1			√			
CO2				√		
CO3			√			
CO4			√			
CO5			√			
CO6				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2				3	3		3	3	3	3
CO2	3	2	3	3	2				3	3		3	3	3	3
CO3	3	1	2	3	1				3	3		3	3	3	3
CO4	3	1	3	3	2				3	3		3	3	3	3
CO5	3	3	3	3	1				3	3		3	3	3	3
CO6	3	3	3	3	2				3	3		3	3	3	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Pointers in C: Declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Null Pointers, Generic Pointers, Pointer to Pointers, Drawback of Pointers, Pointers and Arrays, Arrays of Pointers, Pointers and Two-dimensional Arrays, Pointers and Three-dimensional Arrays, Pointers and Strings.

Structures in C: Introduction, Structure Declaration, Typedef Declarations, Initialization of Structures, Accessing the Members of a Structure, Copying and Comparing Structures, Nested Structures, Arrays of Structures, Structures and

Functions, Passing Individual Members, Passing the Entire Structure, Passing Structures through Pointers, Self-referential Structures.

Introduction to Data Structures: Basic Terminology, Elementary Data Structure Organization, Classification of Data Structures, Operations on Data Structures, Abstract Data Type, Algorithms, Different Approaches to Designing an Algorithm.

Linked Lists: Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Circular Doubly Linked Lists, Header Linked Lists, Multi-linked Lists, Applications of Linked Lists.

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked Representation of Stacks, Operations on a Linked Stack, Multiple Stacks, Applications of Stacks.

Queues: Introduction to Queues, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Applications of Queues.

Heaps: Binary Heaps, Binomial Heaps, Fibonacci Heaps, Binomial, and Fibonacci Heaps, Applications of Heaps.

Graphs: Introduction, Graph Terminology, Directed Graphs, Bi-connected Components, Representation of Graphs.

Trees: Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Huffman's Tree, Applications of Trees.

Efficient Binary Trees: Binary Search Trees, Operations on Binary Search Trees, Threaded Binary Trees, AVL Trees, Red-Black Trees, Splay Trees.

SELF-LEARNING COMPONENTS:

2 Storing game entities in a array
3 Pseudo-random number generators
4 Reversing an array using a stack
5 Matching parentheses and HTML tags
6 Double ended queues
7 Application of tree traversals

TEXTBOOKS:

1. Thareja, Reema. "Data structures using C." (2014).
2. Richard Reese, Understanding and Using C Pointers, First Edition, O'Reilly, 2013.
3. Langsam, Yedidyah, Moshe J. Augenstein, and Aaron M. Tenenbaum. Data Structures using C and C++. Prentice Hall Press, 2000.
4. Seymour Lipschutz, Data Structures With C, Schaum's Outlines, McGraw Hill Education, 2017.
5. Data Structures using C, E Balagurusamy ; McGraw-Hill Education (India), 2013

REFERENCE BOOKS:

1. Richard Gilberg, Behrouz Forouzan, "DataStructures: A Pseudocode Approach with C", Cengage Learning,2004.
2. DebasisSamanta, "Classic DataStructures", second edition, PHI Learning Private Limited,2011.

JOURNALS/MAGAZINES:

1. https://www.imedpub.com/scholarly/data-structure-journals-articles-ppts-list.php
2. https://www.mdpi.com/journal/algorithms/special_issues/Efficient_Data_Structures
3. https://ieeexplore.ieee.org/document/4055607
4. https://ieeexplore.ieee.org/abstract/document/6312216

5. https://www.sciencedirect.com/science/article/pii/0022000083900065
6. https://www.sciencedirect.com/journal/journal-of-algorithms

SWAYAM/NPTEL/MOOCs:

1. Coursera – Data Structures and Algorithms Specialization
2. Coursera – Data Structures, University of California San Diego
3. Data Structures and Algorithms, National Research University Higher School of Economics
4. https://nptel.ac.in/courses/106/102/106102064/
5. https://nptel.ac.in/courses/106/106/106106127/
6. https://nptel.ac.in/courses/106/103/106103069/

Course Title	Object Oriented Programming with Java				Course Type		HC	
Course Code	B24EI0301	Credits	3		Class		III semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42	0	50	50

Pre-requisites: Basic programming knowledge in C/C++ and logic building skills.

COURSE OVERVIEW:

Java is a class-based, object-oriented programming language that is designed to have as few implementation dependencies as possible. It is intended to let application developers write once, and run anywhere (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java was first released in 1995 and is widely used for developing applications for desktop, web, and mobile devices. Java is known for its simplicity, robustness, and security features, making it a popular choice for enterprise-level applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify object oriented programming features, Basic concepts required for the creating java programs, understanding the differences between JDK, JRE, and JVM.	1 to 5,9,10,12	1,2,3
CO2	Make use of concepts of inheritance and polymorphism to improve the code reusability.	1 to 5, 9,10,12	1,2,3
CO3	Develop application using packages, abstract classes, and interfaces in solving complex problems.	1 to 5, 9,10,12	1,2,3
CO4	Understanding usage of String, String constant pool and string methods ,String Builder and String Buffer concepts	1 to 5, 9 to 12	1,2,3
CO5	Understanding Exception Handling and implementing customized exception classes. Also developing applications using inner classes	1 to 5, 9 to 12	1,2,3
CO6	Understanding wrapper classes, generics & collection Framework. And Developing applications using Collection Framework and generics.	1 to 5, 9 to 12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3				3	1		3	3	3	3
CO2	3	2	3	1	3				3	1		3	3	3	3
CO3	3	2	3	2	3				3	2		3	3	3	3
CO4	3	2	3	2	3				3	2	2	3	3	3	3
CO5	3	2	3	2	3				3	2	2	3	3	3	3
CO6	3	2	3	2	3				3	3	3	3	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

OOP CONCEPTS & JAVA FUNDAMENTALS:

Introduction to Software and types of software's, Procedural and object oriented programming paradigm, Differences between C++ and java, Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism. Java programming: History of java, JDK, JRE,JVM Architecture, Java Programming environment, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, control flow statements, jump statements arrays, console input and output, Introducing classes, Methods and Constructors, types of constructors.

INHERITANCE, POLYMORPHISM, PACKAGES AND INTERFACES:

Inheritance: Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. **Packages and interfaces:** Defining package, Types of packages, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces, marker interface.

STRINGS, EXCEPTION HANDLING, INNER CLASSES:

Strings: Introduction to strings, String constant pool, strings methods, String Buffer class, String Builder class, Creating Immutable class, to String(), StringTokenizer class.

Exception Handling: Fundamentals of exception handling, Exception types, Checked and Unchecked Exceptions, using try and catch, try with resource, multiple catch clauses, nested try statements, throw, rethrow, throws and finally, built- in exceptions, creating own exception sub classes, chained exceptions.

Inner classes: Introduction to inner classes, Types of Inner classes.

WRAPPER CLASSES, GENERICS & COLLECTION FRAMEWORK:

Wrapper classes: Introduction to wrapper classes, Auto Boxing and Auto unboxing, types of wrapper classes

Generic Programming and Collections: Generic Classes; Generic Methods; Type Bounds; Type Variance and Wildcards; Restrictions on Generics; an Overview of the Collections Framework, The Collection classes- Array List, Linked List, Hash Set, Tree Set. Map interface, Hash Map, Linked Hash Map, Hash table, Sorted Map interface, Comparable and Comparator interface, Tree Map , java cursors, enum class.

Self Learning Component:

1. The Eclipse-IDE
2. Streams
3. Multithreading
4. JavaFX
5. Networking- JDBC

TEXT BOOKS:

1. Herbert Schildt, "Java™:The Complete Reference",McGraw-Hill,Twelfth Edition,2021.
2. Understanding OOP with Java, up dated edition, T.Budd, Pearson education.

REFERENCE BOOKS:

1. Kathy Sierra and Bert Bates Head First Java, O reilly, 2nd Edition, 2020.
2. Cay S. Horstmann, "Core Java™ Volume I—Fundamentals", Prentice Hall, Tenth Edition, 2015.
3. Joshua Bloch, "Effective Java",Addison-WesleyProfessional,ThirdEdition,2017.
4. David Gallardo, Ed Burnette, Robert Mcgovern,"Eclipse in Action a guide for java developers", Manning Publications,2003.
5. Ed Burnette, "Eclipse IDE Pocket Guide: Using the Full-Featured IDE", O'Reilly Media, Inc, USA,2005.
6. Ken Kousen, "Modern Java Recipes", O'Reilly Media, Inc.,2017.
7. Oracle Java Documentation. (https://docs.oracle.com/javase/tutorial/)

JOURNALS/MAGAZINES:

1. https://www.javadevjournal.com/
2. https://blogs.oracle.com/javamagazine/
3. https://ieeexplore.ieee.org/document/5464387

4. https://files.eric.ed.gov/fulltext/EJ1075126.pdf
5. https://www.sciencedirect.com/science/article/pii/S0167642304000590
6. https://www.informingscience.org/Publications/4322?Source=%2FJournals%2FJITEIIP%2FArticles%3FVolume%3D0-0

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs84/preview
2. https://www.classcentral.com/course/swayam-programming-in-java-12930
3. https://swayam.gov.in/explorer?searchText=java

Course Title	**Digital Logic and Design**				**Course Type**		**HC**	
Course Code	**B24EI0302**	**Credits**	**3**		**Class**		**III Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	**-**	**-**	**-**				
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

This course provides an introduction to Logic design and the basic building blocks used in Digital systems, in particular Digital computers. It starts with the discussion of Combinational Logic: Logic gates, Minimization techniques and Arithmetic circuits. The course introduces theoretical foundationfor Sequential circuits: Flip-flops and Design of Sequential circuits using Moore & Mealy models.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Make use of K Map and Quine McClusky methods for simplifying Boolean expressions;
2. Make choice of suitable data Processing circuits for a given application;
3. Know the behavior of Flip Flops and Use them in building Shift registers and counters.
4. Build Synchronous sequential circuits designed using Moore and Mealy Models.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply knowledge of binary systems, logic gates and Boolean functions to minimize and implement digital circuits	1,2,3,4,5,12	1,2,3
CO2	Understand working of combinational circuits used for Data processing applications	1,2,3,4,5,12	1,2,3
CO3	Analyze the Flip Flops and express their behavior in various forms.	1,2,3,4,5,12	1,2,3
CO4	Analyze and Implement Shift Register, Counters using Flip flops.	1,2,3,4	1,2,3
CO5	Demonstrate models used in the design of sequential circuits.	1,2,3,4,5,12	1,2,3
CO6	Apply Moore and Mealy models for designing sequential circuits.	1,2,3,4,5,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3				√		
CO4				√		
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO/PO				Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	2	1							1	3	3	3
CO 2	3	3	3	3	2							2	3	2	3
CO 3	3	3	2	2	1							1	3	2	3
CO 4	3	3	2									3	3	2	3
CO5	3	2	3	1	1							1	3	2	3
CO6	3	3	3	2	2							2	3	2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Combinational Circuits: Minterms and Maxterms, SOP and POS, The Map Method, Two-Variable K- Map, Three-Variable K-Map, Four Variable K-Maps. Products of Sum Simplification, Sum of Products. Simplification, don't – Care Conditions, NAND and NOR Implementation, Simplification by Quine McClusky method.

Data Processing Circuits: Half adder, Full adder, Half subtractor, Full Subtractor, Binary Adder/ Subtractor, BCD Adder, Fast Adder, Multiplexers, De-Multiplexers, Decoders, Encoders, Magnitude Comparator.

Synchronous Logic: Latches, Flip-Flops-RS, JK, MSJK, T and D, Shift Registers- Types, Ring Counter and Johnson Counter, Counters- Ripple Counters –Analysis and design.

Design of Synchronous Sequential Circuits: Synchronous Counters –Analysis and design, Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, Algorithmic State Machine

SELF-LEARNING COMPONENT:

1. 5-variable K –Map simplification
2. Vending Machine

TEXT BOOKS:

1. D P Leach, A P Malvino, and Goutham Saha, Digital Principles and Applications, Tata McGraw-Hill,8th edition, 2006.

2. Fundamentals of Logic Design, 5/e, Roth, Cengage.

REFERENCE BOOKS:

1. Digital Logic and Computer Design, M.Morris Mano, PEA.

2. Modern Digital Electronics, R.P. Jain, TMH

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108106177
2. https://nptel.ac.in/courses/117105080

Professional Elective - I

<table>
<tr><td>Course Title</td><td colspan="4">Operating Systems</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS311</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course starts with a brief historical perspective of the evolution of operating system and then covers the major components of most of the operating systems. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for allowing resources (e.g., disks, networks, and processors) to be shared, providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer) and protecting individual programs from one another.

Emphasis is given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping) and file systems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the major components and different services of Operating system.
2. Implement process management and scheduling schemes.
3. Discuss synchronization and deadlock techniques in real time applications.
4. Demonstrate memory management techniques for a machine architecture.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the major components and services of Operating System.	1 to 5,12	1
CO2	Summarize process scheduling, scheduling algorithm and multithreading of Operating System.	1 to 5,12	1,2
CO3	Assess the Performance of different CPU Scheduling algorithm for the given real-world applications.	1 to 5,12	1,2
CO4	Apply the concept of synchronization and deadlock process.	1 to 5,12	1,2
CO5	Build methods to overcome synchronization problems and to avoid deadlocks.	1 to 5, 9,12	1,2

CO6	Compare and contrast the physical and virtual memory management techniques.	1 to 5,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2		✓				
CO3						✓
CO4			✓			
CO5			✓			
CO6			✓			

COURSE ARTICULATION MATRIX

CO#/	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	1	1							1	2		
CO2	2	2	2	2	1							1	3	1	
CO3	2	1	2	3	1							1	3	1	
CO4	2	1	2	2	1							1	2	1	
CO5	1	2	1		1							1	2	2	
CO6	1	2	2	1	1							1	1	1	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Operating System Principles: Evolution of Operating Systems, Structural overview, Types of Operating System and operations, Computing environments, Operating System Services, User - Operating System interface, System calls and system programs, Operating System structure.

Process Management: Process concept, process scheduling, Operations on processes, Inter process communication. Multi-Threaded Programming, Overview, Multithreading models, Thread Libraries, threading issues. Process scheduling: Basic concepts, scheduling criteria, scheduling algorithms,

Synchronization and Deadlock: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization: The Bounded-Buffer Problem, The Readers–Writers Problem.

Deadlock definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.

Memory Management: Memory Management Strategies, Swapping, contiguous memory allocation, Paging, structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, copy-on-write, Page replacement, Allocation methods, Thrashing.

SELF-LEARNING COMPONENTS:

Virtual machines and Introduction to Linux Operating System, Introduction to Distributed computing, Parallel computing, grid computing, cloud computing, File System.

PRACTICE:

TEXT BOOKS:

1. Abraham Silberschatz, Peter Bear Galvin, Greg Gagne, Operating System Principles, Wiley Asia Student Edition, 2009.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India, seventh edition, 2011.
3. D. M. Dhamdhere; Operating Systems: A Concept-Based Approach; Tata McGraw-Hill, Third edition 2012.

REFERENCE BOOKS:

1. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, Introduction to Grid Computing, CRC Press, Second Edition, 2014
2. Andrew Tanenbaum & Albert Woodhull, Operating Systems: Design and Implementation. Prentice-Hall, Third edition, 2014.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/document/1658969
2. https://ieeexplore.ieee.org/document/1646682
3. https://ieeexplore.ieee.org/abstract/document/402081

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.coursera.org/lecture/os-power-user/introduction-r0c5h
3. https://onlinecourses.swayam2.ac.in/cec20_cs06/preview

<table>
<tr><td>Course Title</td><td colspan="4">Information and Coding Theory</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS312</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours/ week</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

The Information and Coding Theory course explains the intricate connections between randomness, redundancy, compressibility, noise, bandwidth, and uncertainty within the realm of information theory. It also covers various coding theory topics, including source codes, linear block codes, error detecting codes, cyclic codes, and convolutional codes.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the foundational concepts of probability theory, entropy, and information, and their applications in modeling and analyzing random sources.
2. Explore the characteristics and generation methods of different types of random sources, including independent and identically distributed (iid) and Markov sources.
3. Analyze discrete finite-state stationary Markov sources and their entropy rate, gaining insights into their information content and predictability.
4. Investigate various source coding techniques such as Huffman coding, Lempel-Ziv algorithm, and Shannon-Fano code, and understand their optimality for different types of sources.
5. Learn the principles and design methods of linear block codes for error correction, including Hamming codes, cyclic codes, and Reed-Solomon codes, and their applications in data storage systems.
6. Explore convolutional codes, their properties, encoding methods, and decoding algorithms like the Viterbi algorithm and threshold decoding, for efficient error correction in communication systems.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply probability theory, entropy, and information concepts to model and analyze random sources, assessing their randomness, redundancy, and compressibility.	1-5, 12	1,2,3
CO2	Compare and contrast various types of random sources, including iid and Markov sources, and evaluate their suitability for different applications.	1-5, 12	1,2,3
CO3	Calculate the entropy rate of discrete finite-state stationary Markov sources, providing a quantitative measure of their information content and predictability.	1-5, 12	1,2,3
CO4	Implement source coding techniques such as Huffman coding, Lempel-Ziv algorithm, and Shannon-Fano code, optimizing data compression for different source types.	1-5, 12	1,2,3
CO5	Design and implement linear block codes for error correction, evaluating their performance in data storage systems and other applications.	1-5, 12	1,2,3
CO6	Analyze convolutional codes, understanding their encoding and decoding processes, and assess their performance in error correction for communication systems, considering factors like code distance and decoding complexity.	1-5, 12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				
CO3			✓			
CO4						✓
CO5						✓
CO6				✓		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3							3	2	2	2
CO2	2	3	3	3	3							3	2	2	2
CO3	2	3	3	3	3							3	2	2	2
CO4	3	3	3	3	3							3	2	2	2
CO5	3	3	3	3	3							3	2	2	2
CO6	3	3	3	3	3							3	2	2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Foundations of Information theory: Review of probability theory, entropy and information, random sources, independent and identically distributed (iid) and Markov sources, discrete finite state stationary Markov sources, Entropy rate of stationary sources, Computation of stationary distributions. The concepts of randomness, redundancy, compressibility, noise, bandwidth, and uncertainty are interrelated in the context of information.

Source Coding: Shannon’s Source coding theorem, Huffman coding, Lempel Ziv Algorithm, Prefix, variable and fixed-length codes, Shannon's source coding theorem - Shannon Fano code, Huffman code - optimality - Lempel Ziv code - optimality for stationary ergodic sources.

Linear Block Codes for Error Correction: Introduction to error correcting codes, Specific types of Linear Block Codes (Hamming Codes, Cyclic Codes, Binary Bose-Choudhuri-Hocquenghem (BCH) codes, Reed–Solomon codes), Design of optimal linear block codes, Applications of Block codes for Error control in data storage System
Cyclic Codes: Definition and Representation, Algebraic Encoding of Cyclic Codes, Generator and Parity-check Matrices, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes

Convolutional Codes: Representation and Properties, Convolutional Codes Encoding, Graphic Representation of Convolutional Codes, Code Distance and d ∞, Decoding (Viterbi Algorithm, Threshold Decoding)

SELF LEARNING COMPONENT:

Space Time Block Codes (STBC)
Neural Block Codes

TEXT BOOKS:

1. **T. M. Cover and J. A. Thomas, Elements of Information Theory, Addison Wesley, 1999.**

2. **Borda M. Fundamentals in Information Theory and Coding, Germany: Springer Berlin Heidelberg, 2011.**
3. **Ranjan B, Information Theory Coding and Cryptography, Tata McGraw Hill, New Delhi,2008**

REFERENCE BOOKS:

1. **Information Theory and Coding, Norman Abramson, McGraw-Hill, 1963.**
2. **Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.**
3. **Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989.**

SWAYAM NPTEL/MOOCs

NPTEL courses on NOC: Information Theory, Coding and Cryptography, IIT Delhi Prof. Ranjan Bose
https://nptel.ac.in/courses/108102117

<table>
<tr><td>Course Title</td><td colspan="4">Foundation to AI</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS313</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2">40</td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course provides a comprehensive introduction to the field of Artificial Intelligence (AI). It covers fundamental concepts, techniques, and applications of AI, focusing on problem-solving, intelligent agents, search strategies, knowledge representation, reasoning, and planning. Through a combination of theoretical lessons and practical assignments, students will learn to design and implement AI systems that can interact intelligently with their environment.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the architecture of intelligent agents and their interactions with environments
2. Develop the ability to analyze different search strategies and compare their effectiveness.
3. Encourage students to develop solutions for planning problems and manage uncertainty in AI systems.
4. Assess the effectiveness of different AI techniques and approaches in solving real-world problems.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify key problems and historical milestones in AI development.	1-3	1
CO2	Understand the principles of knowledge representation and reasoning in AI.	4-5	2
CO3	Implement intelligent agents and AI algorithms in programming environments.	4-5	2
CO4	Design and develop AI solutions for complex problem-solving and planning tasks.	7-8	2
CO5	Integrate various AI techniques to create comprehensive AI systems.	9-10	3
CO6	Critically assess the performance of AI systems and algorithms.	10-11	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√				
CO3			√			
CO4				√		
CO5						√
CO6					√	

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										3	2	1
CO2		2	2	2	2								2	2	2
CO3			3	3	3								2	2	2
CO4							2	2					3	3	3
CO5									3	3			2	2	2
CO6											2	2	1	2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Introduction to AI, Problems of AI, AI Techniques, Tic-Tac-Toe Problem, Intelligent Agents: Agents and Environment, Nature of Environment, Structure of Agents, Goal-Based Agents, Utility-Based Agents, Learning Agents

Problem-Solving and Search Strategies, Defining Problems as State Space Search, Production Systems, Problem Characteristics, Issues in the Design of Search Programs, Uniform Search Strategies, Problem-Solving Agents, Searching for Solutions, Breadth-First Search, Depth-First Search, Comparing Uniform Search Strategies, Heuristic Search Strategies, Greedy Best-First Search, A* Search, AO* Search

Local Search Algorithms and Optimization Problems, Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Local Search for Constraint Satisfaction Problems, Adversarial Search and Games, Optimal Decisions and Strategies in Games, Minimax Search Procedure, Alpha-Beta Pruning

Knowledge Representation and Reasoning, Knowledge Representation Issues, Representation and Mapping, Approaches to Knowledge Representation, Using Predicate Logic, Representing Simple Facts in Logic, Representing Instances and ISA Relationships, Computable Functions and Predicates, Resolution and Natural Deduction

Logic Programming, forward vs. Backward Reasoning, Matching and Control Knowledge, Uncertainty in AI, Representing Knowledge in an Uncertain Domain, Semantics of Bayesian Networks, Dempster-Shafer Theory, Planning in AI, Planning Overview, Components of a Planning System, Goal Stack Planning, Hierarchical Planning

SELF LEARNING COMPONENTS:

Online Tutorials and Courses, Coursera: "Machine Learning" by Andrew Ng, edX: "Artificial Intelligence (AI)" by Columbia University, Udacity: "AI for Robotics" by Sebastian Thrun, **Participation in AI Competitions**, Kaggle: Participate in machine learning competitions, DrivenData: Engage in data science competitions focused on social impact. **To develop practical AI applications**: Developing a chatbot using natural language processing, Creating a recommendation system, Implementing a game-playing AI (e.g., Tic-Tac-Toe, Chess).

TEXT BOOKS:

1. Russell, S. J., & Norvig, P. (2016). *Artificial intelligence: a modern approach*. Pearson.
2. Rich, E. Kevin Knight y Shivashankar B. Nair. *Artificial Intelligence*.

REFERENCE BOOKS:

1. "Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth
2. "Pattern Recognition and Machine Learning" by Christopher M. Bishop
3. "Prolog Programming for Artificial Intelligence" by Ivan Bratko

JOURNALS/MAGAZINES:

1. Journal of Artificial Intelligence Research (JAIR)
2. Artificial Intelligence (Elsevier)
3. IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)

SWAYAMNPTEL/MOOCs

1. Coursera: "Machine Learning" by Andrew Ng
2. edX: "Artificial Intelligence (AI)" by Columbia University
3. Udacity: "AI for Robotics" by Sebastian Thrun

Course Title	Introduction to Verilog				Course Type		SC	
Course Code	B24EIS314	Credits	3		Class		III semester	
	LTP	s	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

This subject deals studying the basics of verilog, a programming language for developing the hardware circuits. In this subject the students will be exposed to basic programming fundamentals of developing a circuit with verilog. The students learns the techniques with hierarchical modeling, behavioral modeling and gate level modeling

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Study the basic of digital design using Verilog HDL.
2. Learn the fundamental of digital design using hierarchical modeling
3. Write verilog code to simulate a digital circuit using behavioral modeling
4. Simulate the verilog code written in gate level modeling to see the output of the circuits.

COURSE OUTCOMES(COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Learn the basic concepts of digital design using verilog HDL.	1,2 ,9,12	1,2
CO2	Understand the working of a circuit done using hierarchical modeling	1 to 4 ,9,12	1,2
CO3	Write different program to learn digital design using gate level modeling	1 to 4,9,12	1,2,3
CO4	Interface the different devices and write verilog code to interface the devices.	1to 5,9,12	1,2
CO5	Experiment digital design using behavioral modeling.	1to 4,9,12	1,2
CO6	Illustrate different experiment using verilog code with Intel Quartus	1to 5,9,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember **(L1)**	**Understand** **(L2)**	**Apply** **(L3)**	**Analyze** **(L4)**	**Evaluate** **(L5)**	**Create** **(L6)**
CO1		√				
CO2		√				
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	√	√							√			√	√	√	
CO2	√	√	√	√					√			√	√	√	
CO3	√	√	√	√					√			√	√	√	√
CO4	√	√	√	√	√				√			√	√	√	
CO5	√	√	√	√					√			√	√	√	
CO6	√	√	√	√	√				√			√	√	√	√

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Overview of Digital Design with Verilog HDL 8 hours

Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, whyVerilog IIDL?, trends in HDLs.
Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.
Basic Concepts 8 hours

Basic Concepts: Lexical conventions, datatypes, system tasks, compiler directives.
Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing.

Gate-Level Modeling 8 hours

Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.

Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types.

Behavioral Modeling 8 hours

Behavioral Modeling: Structured procedures, initial and always, blocking and non blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.

Tasks and Functions: Differences between tasks and functions, declaration, invocation, automatic tasks and functions.

TextBook:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.

Reference Books:

1. Donald E. Thomas, Philip R Moorby, 'The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.

2 Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.

3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016.

SWAYAM NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106103358
2. https://nptel.ac.in/courses/106105165
3. **https://nptel.ac.in/courses/108103179**

<table>
<tr><td>Course Title</td><td colspan="4">Data Structures Lab Using C</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0304</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

This course, "Data Structures Using C," provides a comprehensive introduction to fundamental data structures and their applications, using the C programming language as the primary tool for implementation. Designed for students with basic programming knowledge, the course aims to equip them with the skills needed to efficiently store, manage, and manipulate data. Through a series of hands-on experiments and mini-projects, students will explore a variety of data structures, including linked lists, stacks, queues, trees, heaps, and graphs. They will learn to implement these structures, understand their underlying principles, and apply them to solve complex problems. Overall, this course not only teaches the technical aspects of data structures but also encourages analytical thinking and effective programming practices, preparing students for advanced studies and careers in computer science and software engineering.

COURSE OBJECTIVES:

The objectives of this course are to

1. Master fundamental C programming concepts such as pointers, dynamic memory allocation, and structures.
2. Gain a deep understanding of various data structures, including arrays, linked lists (singly, doubly, and circular), stacks, and queues.
3. Learn to implement and manipulate advanced tree structures like Binary Search Trees (BSTs), AVL trees, Red-Black trees, Splay trees, and Threaded Binary trees.
4. Implement and analyze algorithms for managing priority queues using binary heaps, and perform file compression using Huffman coding.
5. Utilize learned data structures to design and develop real-world applications such as a student enrollment system, library management system, music playlist management, and text editor auto-complete features.
6. Undertake mini-projects that synthesize course concepts to solve complex problems, enhancing problem-solving and project management skills.

COURSE OUTCOMES:

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate proficiency in advanced C programming concepts, including pointers, dynamic memory allocation, and structures.	1, 5, 8, 12	1, 3
CO2	Implement and manipulate essential data structures such as arrays, linked lists, stacks, and queues in C.	1, 2, 4, 5, 9	1, 2, 3
CO3	Develop and apply advanced tree and graph structures, including various trees (BST, AVL, Red-Black) and graph traversal algorithms (BFS, DFS).	1, 2, 4, 5, 8	1, 2, 3
CO4	Design and implement algorithms for managing data efficiently, such as priority queues, Huffman coding, and database indexing.	1, 2, 4, 5, 11	1, 2, 3
CO5	Create practical applications, leveraging learned data structures to solve real-world problems in domains like enrollment systems, library management, and more.	1, 2, 4, 5, 6, 11	1, 2, 3
CO6	Enhance the problem-solving and project management abilities through mini-projects that integrate course concepts to address complex challenges.	1, 4, 9, 11, 12	1, 2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓			
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2				3	3		3	3	3	3
CO2	3	2	3	3	2				3	3		3	3	3	3
CO3	3	1	2	3	1				3	3		3	3	3	3
CO4	3	1	3	3	2				3	3		3	3	3	3
CO5	3	3	3	3	1				3	3		3	3	3	3
CO6			3	2	3				2			3	3	3	3

Note:1-Low,2-Medium,3-High

PRACTICE:

No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill / Ability**
C Programming (Practice Experiments 1 to 5 - Not to be Examined)			
Experiment 1: Implementation of Pointer Variables and Pointer Arithmetic			
a	**Swapping Two Numbers Using Pointers** Write a C program to swap two integers using pointers. The program should prompt the user to enter two numbers and then display the numbers before and after swapping.	C programming language, Pointer manipulation	Pointers
b	**Calculating the Average of Array Elements Using Pointers** Write a C program to calculate the average of an array of integers using pointers. The program should dynamically allocate memory for an array, accept input from the user, and then compute and display the average using pointer arithmetic.	C programming language, dynamic memory allocation	Dynamic memory allocation
Experiment 2: Working with Null Pointers, Generic Pointers, Pointers to Pointers, and Pointer Arrays			
a	**Handling Null Pointers** Write a C program that demonstrates the use of null pointers. The program should attempt to dereference a null pointer and handle the resulting error gracefully by checking for null before dereferencing.	C programming language, Null pointer handling, error checking	Error handling, and conditional checks

b	**Using Generic Pointers (void pointers)** Write a C program that uses a generic pointer (void pointer) to store and print different types of data (int, float, char). The program should use type casting to handle the void pointer appropriately.	C programming language, Void pointers, type casting	Working with different data types using void pointers
c	**Pointers to Pointers** Write a C program that demonstrates the use of pointers to pointers by dynamically allocating a two-dimensional array using pointers to pointers. The program should accept input to fill the array and then display the array.	C programming language, dynamic memory allocation, Pointers to pointers, two-dimensional arrays	Working with multi-dimensional arrays using pointers.
d	**Array of Pointers to Strings** Write a C program that creates an array of pointers to strings (character arrays). The program should store a list of strings (names), allow the user to input names, and then display the list of names using pointer notation.	C programming language, string manipulation, Array of pointers, string handling	String manipulation, and pointer notation for accessing elements
Experiment 3: Implementing and Manipulating Two-dimensional and Three-dimensional Arrays Using Pointers			
a	**Two-dimensional Array Using Pointers** Write a C program that dynamically allocates memory for a two-dimensional array using pointers. The program should prompt the user to enter the number of rows and columns, accept input to fill the array, and then display the array.	C programming language, dynamic memory allocation, Pointers, dynamic memory management, array manipulation	Dynamic memory allocation for two-dimensional arrays
b	**Matrix Multiplication Using Pointers** Write a C program to perform matrix multiplication using dynamically allocated two-dimensional arrays. The program should prompt the user for the dimensions and elements of two matrices, perform the multiplication, and display the resulting matrix.	C programming language, dynamic memory allocation, Pointers, dynamic memory management, matrix manipulation	Dynamic memory allocation for matrices
c	**Three-dimensional Array Using Pointers** Write a C program that dynamically allocates memory for a three-dimensional array using pointers. The program should prompt the user to enter the dimensions, accept input to fill the array, and then display the array.	C programming language, dynamic memory allocation, Pointers, dynamic memory management, array manipulation	Dynamic memory allocation for three-dimensional arrays
Experiment 4: Creating and Using Structures			
a	**Employee Management System** Write a C program to create a structure called Employee with fields for employee ID, name, department, and salary. Use an array of structures to store information for multiple employees. The program should include functions to: ○ Accept details for multiple employees. ○ Display details of all employees. ○ Modify the salary of an employee given their ID.	C programming language, structures, arrays, Structure manipulation, array handling, input/output	Structure definition, array of structures, accessing and modifying structure members.
b	**Library System with Nested Structures** Write a C program to create a structure called Book with fields for book ID, title, author, and a nested structure Date (with fields for day, month, and year) to store the publication date. Use an array of Book structures to manage a collection of books. The program should: ○ Accept details for multiple books. ○ Display details of all books.	C programming language, structures, arrays, Nested structures, array manipulation, search algorithms	Nested structures, array of structures, accessing nested structure members.

	○ Find and display books published in a particular year.		
c	**Self-Referential Structures for Linked List** Write a C program to implement a singly linked list using a self-referential structure Node with fields for an integer data and a pointer to the next node. The program should include functions to: ○ Insert a node at the beginning. ○ Insert a node at the end. ○ Display all nodes in the linked list.	C programming language, structures, pointers, Linked list implementation, pointer manipulation, memory management	Self-referential structures, dynamic memory allocation, linked list operations.
d	**Student Records System** Write a C program to create a structure called Student with fields for student ID, name, and an array of marks for 5 subjects. Use an array of structures to store records for multiple students. The program should: ○ Accept details for multiple students. ○ Calculate and display the average marks for each student. ○ Find and display the student with the highest average marks.	C programming language, structures, arrays, Array of structures, input/output, data manipulation	Arrays within structures, array of structures, accessing and modifying structure members.
Experiment 5: Passing Structures to Functions			
a	**Bank Account Management** Write a C program to create a structure called BankAccount with fields for account number, account holder's name, and balance. Implement functions to: ○ Accept account details (by value). ○ Display account details (by value). ○ Deposit money (by reference). ○ Withdraw money (by reference).	C programming language, structures, functions, Structure manipulation, input/output, pass by value/reference	Passing structures by value and by reference, accessing structure members within functions.
b	**Comparing Dates** Write a C program to create a structure called Date with fields for day, month, and year. Implement functions to: ○ Accept a date (by value). ○ Display a date (by value). ○ Compare two dates (by value) and return -1, 0, or 1 if the first date is earlier than, equal to, or later than the second date respectively.	C programming language, structures, functions, Structure manipulation, input/output, conditional statements	Passing structures by value, structure comparison, returning values from functions.
c	**Copying and Comparing Student Records** Write a C program to create a structure called Student with fields for student ID, name, and an array of marks for 5 subjects. Implement functions to: ○ Accept student details (by reference). ○ Copy the details of one student to another (by reference). ○ Compare two students based on their total marks (by reference) and return the student with higher marks.	C programming language, structures, functions, Structure manipulation, array handling, conditional statements	Passing structures by reference, structure copying, structure comparison.
d	**Rectangle Operations** Write a C program to create a structure called Rectangle with fields for length and width. Implement functions to: ○ Accept rectangle dimensions (by value). ○ Display rectangle dimensions (by value). ○ Calculate and return the area of the rectangle (by value). ○ Calculate and return the perimeter of the rectangle (by reference).	C programming language, structures, functions, Structure manipulation, input/output, pass by value/reference, mathematical operations	Passing structures by value and by reference, returning values from functions.

PART - A **Data Structures (Experiments 6 to 17 – To be Examined)**			
Experiment 6: Implementing Singly Linked Lists			
a	**Student Enrollment System** Write a C program to manage student enrollments using a singly linked list. Each node in the list should represent a student with fields for student ID, name, and age. The program should include functions to: ○ Create the linked list by adding new students. ○ Traverse and display the list of students. ○ Insert a new student at a specific position. ○ Delete a student by their ID.	C programming language, singly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Node creation, linked list traversal, insertion at a specific position, deletion by key.
b	**To-Do List Management** Write a C program to manage a to-do list using a singly linked list. Each node should represent a task with fields for task ID, description, and priority. The program should include functions to: ○ Add a new task to the list. ○ Display all tasks in the list. ○ Insert a task at the beginning of the list. ○ Delete a task from the end of the list.	C programming language, singly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Node creation, insertion at the beginning, deletion from the end, traversal.
c	**Library Book Inventory** Write a C program to manage a library's book inventory using a singly linked list. Each node should represent a book with fields for book ID, title, and author. The program should include functions to: ○ Add a new book to the inventory. ○ Traverse and display the list of books. ○ Insert a book at the end of the list. ○ Delete a book by its title.	C programming language, singly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Node creation, traversal, insertion at the end, deletion by key.
Experiment 7: Implementing Doubly Linked Lists and Circular Linked Lists			
a	**Music Playlist Management (Doubly Linked List)** Write a C program to manage a music playlist using a doubly linked list. Each node should represent a song with fields for song ID, title, and artist. The program should include functions to: ○ Create the playlist by adding new songs. ○ Traverse and display the playlist from start to end and from end to start. ○ Insert a new song at a specific position. ○ Delete a song by its ID.	C programming language, doubly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Node creation, bidirectional traversal, insertion at a specific position, deletion by key.
b	**Circular Queue of Customers (Circular Linked List)** Write a C program to manage a queue of customers using a circular linked list. Each node should represent a customer with fields for customer ID, name, and service type. The program should include functions to: ○ Add a new customer to the queue. ○ Display the queue of customers. ○ Insert a customer at the beginning of the queue. ○ Delete a customer from the end of the queue.	C programming language, circular linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Circular structure, traversal, insertion at the beginning, deletion from the end.
c	**Train Compartment Management (Circular Doubly Linked List)** Write a C program to manage train compartments using a circular doubly linked list. Each node should represent a compartment with fields for compartment number, capacity, and occupancy. The program should include functions to: ○ Add a new compartment to the train. ○ Traverse and display the list of compartments in both directions.	C programming language, circular doubly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Circular doubly linked structure, bidirectional traversal, insertion at a specific position, deletion by key.

	○ Insert a new compartment at a specific position. ○ Delete a compartment by its number.		
d	**Double-Ended Queue (Doubly Linked List)** Write a C program to implement a double-ended queue (deque) using a doubly linked list. Each node should represent an element with an integer value. The program should include functions to: ○ Add an element at the front of the deque. ○ Add an element at the rear of the deque. ○ Remove an element from the front of the deque. ○ Remove an element from the rear of the deque. ○ Display the elements in the deque from front to rear and rear to front.	C programming language, doubly linked list, structures, Linked list manipulation, dynamic memory allocation, input/output	Node creation, insertion and deletion at both ends, bidirectional traversal.
Experiment 8: Implementing Stack Operations and Applications			
a	**Web Browser History (Array-based Stack)** Write a C program to simulate the back button functionality in a web browser using a stack implemented with arrays. Each entry in the stack should represent a URL visited by the user. The program should include functions to: ○ Push a new URL onto the stack when a new page is visited. ○ Pop the top URL from the stack when the back button is pressed. ○ Peek at the current URL without removing it from the stack. ○ Display the current stack of URLs.	C programming language, array-based stack, functions, Stack implementation using arrays, push and pop operations, input/output	Stack operations (push, pop, peek), array implementation, simulation of real-world application.
b	**Expression Evaluation (Linked List-based Stack)** Write a C program to evaluate a postfix expression using a stack implemented with linked lists. The program should: ○ Read a postfix expression from the user. ○ Use stack operations to evaluate the expression. ○ Display the result of the evaluation.	C programming language, linked list-based stack, functions, Stack implementation using linked lists, postfix expression evaluation, input/output	Stack operations (push, pop), linked list implementation, postfix expression evaluation.
c	**Infix to Postfix Conversion** Write a C program to convert an infix expression to a postfix expression using a stack implemented with arrays. The program should: ○ Read an infix expression from the user. ○ Use stack operations to convert the infix expression to a postfix expression. ○ Display the converted postfix expression.	C programming language, array-based stack, functions, Stack implementation using arrays, infix to postfix conversion algorithm, input/output	Stack operations (push, pop, peek), precedence and associativity of operators, infix to postfix conversion algorithm.
Experiment 9: Implementing Queue Operations			
a	**Customer Service Queue (Array-based Queue)** Write a C program to manage a customer service queue using a queue implemented with arrays. Each entry in the queue should represent a customer with fields for customer ID and name. The program should include functions to: ○ Enqueue a new customer. ○ Dequeue a customer when they are served. ○ Display the current queue of customers.	C programming language, array-based queue, functions, Queue implementation using arrays, enqueue and dequeue operations, input/output	Queue operations (enqueue, dequeue), array implementation, simulation of customer service.

b	**Printer Job Queue (Linked List-based Queue)** Write a C program to manage a printer job queue using a queue implemented with linked lists. Each entry in the queue should represent a print job with fields for job ID and number of pages. The program should include functions to: ○ Enqueue a new print job. ○ Dequeue a print job when it is completed. ○ Display the current queue of print jobs.	C programming language, linked list-based queue, functions, Queue implementation using linked lists, enqueue and dequeue operations, input/output	Queue operations (enqueue, dequeue), linked list implementation, simulation of a print queue.
c	**Circular Queue for Ticket Booking** Write a C program to manage a circular queue for booking tickets using an array. Each entry in the queue should represent a ticket request with fields for request ID and number of tickets. The program should include functions to: ○ Enqueue a new ticket request. ○ Dequeue a ticket request when it is processed. ○ Display the current queue of ticket requests.	C programming language, circular queue, functions, Queue implementation using circular arrays, enqueue and dequeue operations, input/output	Circular queue operations (enqueue, dequeue), array implementation, circular buffer concept.
d	**Priority Queue for Task Scheduling** Write a C program to manage a priority queue for task scheduling using a linked list. Each entry in the queue should represent a task with fields for task ID, task description, and priority level. The program should include functions to: ○ Enqueue a new task based on its priority. ○ Dequeue the highest priority task. ○ Display the current queue of tasks.	C programming language, priority queue, linked list, functions, Priority queue implementation using linked lists, enqueue and dequeue operations based on priority, input/output	Priority queue operations (enqueue with priority, dequeue), linked list implementation, task scheduling based on priority.
Experiment 10: Implementing Heaps			
a	**Priority Queue for Task Management (Binary Heap)** Write a C program to manage a priority queue for task management using a binary heap. Each task should have a priority level and a description. The program should include functions to: ○ Insert a new task into the heap. ○ Delete the highest priority task from the heap. ○ Display the current tasks in the heap.	C programming language, binary heap data structure, Priority queue implementation,	Binary heap properties, insertion (heapify-up), deletion (heapify-down), priority queue management.
b	**Comparing Binary Heaps, Binomial Heaps, and Fibonacci Heaps** Write a C program to compare the performance of binary heaps, binomial heaps, and Fibonacci heaps. The program should: ○ Implement insertion and deletion operations for all three types of heaps. ○ Measure the time taken for a series of random insertions and deletions in each type of heap. ○ Display and compare the results.	binary heap operations (insertion, deletion), memory management	Understanding different heap structures, implementing heap operations, performance analysis.
Experiment 11: Implementing Graphs			
a	**Social Network Graph (Adjacency Matrix)** Write a C program to represent a social network using an adjacency matrix. Each node represents a user, and an edge represents a friendship. The program should include functions to: ○ Add a new user. ○ Add a friendship between two users. ○ Display the adjacency matrix. ○ Perform BFS to find the shortest path between two users.	C programming language, adjacency matrix representation, Matrix operations, graph representation, Breadth-First Search	Graph representation using adjacency matrix, graph traversal (BFS), shortest path finding.

		(BFS), dynamic memory allocation	
b	**Road Network Graph (Adjacency List)** Write a C program to represent a road network using an adjacency list. Each node represents a city, and an edge represents a road between cities with a certain distance. The program should include functions to: ○ Add a new city. ○ Add a road between two cities. ○ Display the adjacency list. ○ Perform DFS to find all cities reachable from a given city.	C programming language, adjacency list representation, Linked list operations, graph representation, Depth-First Search (DFS), dynamic memory allocation	Graph representation using adjacency list, graph traversal (DFS), reachability in graphs.
c	**Graph Traversal Algorithms** Write a C program to implement basic graph traversal algorithms (BFS and DFS) on a given graph. The program should: ○ Allow the user to input a graph. ○ Perform BFS starting from a specified node and display the traversal order. ○ Perform DFS starting from a specified node and display the traversal order.	C programming language, graph representation (adjacency matrix or list), Graph input handling, Breadth-First Search (BFS), Depth-First Search (DFS), traversal algorithms, dynamic memory allocation	BFS and DFS algorithms, graph traversal techniques, user input handling.
Experiment 12: Binary Search Trees (BST)			
	Implementing a Binary Search Tree Write a C program to implement a Binary Search Tree (BST). The program should include functions to: ○ Insert a new node. ○ Delete a node. ○ Search for a node. ○ Traverse the tree in-order, pre-order, and post-order. ○ Find the minimum and maximum value nodes.	C programming language, pointers, structs, Tree data structure implementation Binary search tree operations (insertion, deletion, search)	BST properties, insertion, deletion, search, tree traversal, minimum and maximum node retrieval.
Experiment 13: Operations on Binary Search Trees			
	Advanced BST Operations Write a C program to perform the following operations on a BST: ○ Determine the height of the tree. ○ Count the number of nodes in the tree. ○ Find the mirror image of the tree. ○ Check if the tree is balanced.	C programming language, pointers, structs, Binary Search Tree (BST) operations	Tree height calculation, node count, tree mirroring, balance checking.
Experiment 14: Threaded Binary Trees			
	Implementing a Threaded Binary Tree Write a C program to implement a Threaded Binary Tree. The program should include functions to: ○ Insert nodes in the threaded binary tree. ○ Perform in-order traversal using threads. ○ Perform pre-order and post-order traversals without recursion or stack.	C programming language, pointers, structs, Threaded Binary Tree implementation	Threaded binary tree structure, threaded in-order traversal, non-recursive traversals.
Experiment 15: AVL Trees			
	Implementing an AVL Tree Write a C program to implement an AVL Tree. The program should include functions to: ○ Insert nodes and maintain balance using rotations (single and double). ○ Delete nodes and maintain balance.	C programming language, pointers, structs, AVL Tree implementation	AVL tree properties, rotations (left, right, left-right, right-left), balanced tree maintenance, balance factor calculation.

	○ Perform in-order, pre-order, and post-order traversals. ○ Check the balance factor of each node.	Node insertion with balancing (single and double rotations: left, right, left-right, right-left)	
Experiment 16: Red-Black Trees			
	Implementing a Red-Black Tree Write a C program to implement a Red-Black Tree. The program should include functions to: ○ Insert nodes and maintain Red-Black properties. ○ Delete nodes and maintain Red-Black properties. ○ Perform in-order, pre-order, and post-order traversals. ○ Verify the properties of the Red-Black Tree.	C programming language, pointers, structs, Red-Black Tree implementation	Red-Black Tree properties, color handling, rotations, insertion and deletion with property maintenance.
Experiment 17: Splay Trees			
	Implementing a Splay Tree Write a C program to implement a Splay Tree. The program should include functions to: ○ Insert nodes into the splay tree. ○ Delete nodes from the splay tree. ○ Search for nodes and splay them to the root. ○ Perform in-order, pre-order, and post-order traversals.	C programming language, pointers, structs, Splay Tree implementation	Splay tree operations, splaying mechanism, self-adjusting properties, tree traversal.
PART - B **Data Structures (Mini-Project – To be Examined)** **Note: Each student shall be assigned any one of the following mini-projects**			
1	**Priority Queue Management System using Binary Heap**: ○ Implement a priority queue management system using a binary heap. Users can enqueue tasks with priorities and dequeue them according to their priorities. ○ Operations: Insertion (enqueue), Deletion (dequeue), Peek (retrieve highest priority task).	C programming language, binary heap data structure, Priority queue implementation, binary heap operations (insertion, deletion), memory management	
2	**Shortest Path Finding using Dijkstra's Algorithm with Fibonacci Heap**: ○ Implement Dijkstra's shortest path algorithm using a Fibonacci heap for efficient priority queue management. ○ Input: Weighted directed graph. ○ Output: Shortest path from a source vertex to all other vertices.	C programming language, graph data structure, Fibonacci heap, Dijkstra's shortest path algorithm, graph traversal, Fibonacci heap operations	
3	**File Compression using Huffman Coding**: ○ Implement file compression using Huffman coding with a binary tree. ○ Input: Text file. ○ Output: Compressed file and Huffman tree.	C programming language, binary tree data structure, Huffman coding algorithm, binary tree traversal, file I/O	
4	**Social Network Analysis using Graphs**: ○ Create a social network analysis tool using graph data structures. ○ Features: Add users as vertices, add friendships as edges, find mutual friends, suggest friends based on common connections, identify communities using graph algorithms.	C programming language, graph data structure, Graph manipulation, community detection algorithms, friend suggestion algorithms	

5	**Expression Parsing using Binary Trees**: ○ Implement an expression parser using binary trees to represent arithmetic expressions. ○ Features: Parse infix expressions into binary expression trees, evaluate expressions, and perform basic arithmetic operations.	C programming language, binary tree data structure, Expression parsing, infix to binary expression tree conversion, arithmetic operations
6	**Database Indexing using AVL Trees**: ○ Create a database indexing system using AVL trees to efficiently store and retrieve data. ○ Features: Insertion of records, deletion of records, searching records, maintaining balanced AVL trees for efficient indexing.	C programming language, AVL tree data structure, Indexing, balanced tree operations, database operations
7	**Text Editor Auto-complete using Trie**: ○ Develop a text editor auto-complete feature using a trie data structure. ○ Features: Insertion of words, searching for words with prefix, suggesting auto-complete options based on user input.	C programming language, trie data structure, Text processing, auto-complete feature, trie operations
8	**Symbol Table Implementation using Red-Black Trees**: ○ Implement a symbol table for a compiler using red-black trees. ○ Features: Insertion of identifiers, searching for identifiers, maintaining balanced red-black trees for efficient symbol lookup.	C programming language, red-black tree data structure, Symbol table implementation, balanced tree operations, compiler optimization
9	**Cache Optimization using Splay Trees**: ○ Implement a cache optimization algorithm using splay trees. ○ Features: Cache storage, access tracking, splay tree operations to promote frequently accessed items for faster retrieval.	C programming language, splay tree data structure, Cache optimization, access tracking, splay tree operations
10	**Network Routing using Bi-connected Components**: ○ Develop a network routing algorithm using bi-connected components in graphs. ○ Features: Identifying critical nodes and edges, ensuring redundancy in network paths, handling network failures.	C programming language, graph data structure, Network routing algorithms, bi-connected components, redundancy handling

TEXTBOOKS:

1. Thareja, Reema. "Data structures using C." (2014).
2. Richard Reese, Understanding and Using C Pointers, First Edition, O’Reilly, 2013.
3. Langsam, Yedidyah, Moshe J. Augenstein, and Aaron M. Tenenbaum. Data Structures using C and C++. Prentice Hall Press, 2000.
4. Seymour Lipschutz, Data Structures With C, Schaum’s Outlines, McGraw Hill Education, 2017.
5. Data Structures using C, E Balagurusamy ; McGraw-Hill Education (India), 2013

REFERENCE BOOKS:

1. Richard Gilberg, Behrouz Forouzan, “DataStructures: A Pseudocode Approach with C”, Cengage Learning,2004.
2. DebasisSamanta, “Classic DataStructures”, second edition, PHI Learning Private Limited,2011.

JOURNALS/MAGAZINES:

1. https://www.imedpub.com/scholarly/data-structure-journals-articles-ppts-list.php
2. https://www.mdpi.com/journal/algorithms/special_issues/Efficient_Data_Structures
3. https://ieeexplore.ieee.org/document/4055607
4. https://ieeexplore.ieee.org/abstract/document/6312216
5. https://www.sciencedirect.com/science/article/pii/0022000083900065

6. https://www.sciencedirect.com/journal/journal-of-algorithms

SWAYAM/NPTEL/MOOCs:

1. Coursera – Data Structures and Algorithms Specialization
2. Coursera – Data Structures, University of California San Diego
3. Data Structures and Algorithms, National Research University Higher School of Economics
4. https://nptel.ac.in/courses/106/102/106102064/
5. https://nptel.ac.in/courses/106/106/106106127/
6. https://nptel.ac.in/courses/106/103/106103069/

<table>
<tr><td>Course Title</td><td colspan="4">Object Oriented Programming with Java lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0303</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

Java's unique architecture enables programmers to develop a single application that can run across multiple platforms seamlessly and reliably. In this course, students gain hands-on experience on using fundamental & advanced java concepts and also learn to use tools to execute java programs.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate extending a class (inheritance) and use proper program anomaly handling structures.
4. Illustrate creation of windows applications using swings and event handling.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design and develop java programs for solving simple problems using fundamental concepts.	1 to 5,9,10,12	1,3
CO2	Use arrays and other data structures to organize and use data to solve real world problems.	1 to 5, 9,10,12	1,3
CO3	Make use of properties of one class in another using inheritance.	1 to 5, 9,10,12	2, 3
CO4	Implement Exception Handling to develop effective applications using java.	1 to 5, 9,10,12	2
CO5	Design java programs to achieve type safety using generic classes and methods.	1 to 5, 9,10,12	1,3
CO6	Make use of wrapper classes and collection classes for high performance implementations	1 to 5, 9,10,12	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1				3	3		2	3		3
CO2	3	3	2	2	1				3	3		2	3		3
CO3	3	3	1	1	1				3	3		2		3	3
CO4	3	3	3	1	2				3	3		2		3	
CO5	3	1	2	1	3				3	3		2	3		3
CO6	3	1	2	1	3				3	3		2	3		3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

PRACTICAL:

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1.	Write a java program to create a console application that allows the user to choose an arithmetic operation able to provide his choice of operands for the same. Display the appropriate output. Note: Use switch statement to perform the operations.	Netbeans IDE	Understanding of Multi-way branch statement
2.	A String is a collection of characters, a given string can be a combination of vowels and consonants. Develop a java program to count the number of vowels and consonants in a string.	NetBeans IDE	Logic building & String operations

3.	Using a one dimensional array, read an array of integer elements and perform the following operations. Copy all elements from one array to another. Remove duplicate elements from array and print only even position of array.	Netbeans IDE	Array concepts and logic building
4.	Develop a JAVA program to write an application to create student database to input name, SRN and college name, where college name should be declared as static variable and perform the following tasks. Create a class with static variable. Insert some values into the members of the class including static member and display the values of the members. Change the value of static variable and display the updated values of the members.	Netbeans IDE	Types of variables and their scope
5.	Volume of a box to be computed using different features of a box: height, width and depth. Write a generic java program that accepts the values of the features of a box during the construction of its object and calculate its volume and display the same. Note: Student should identify the classes, data and function members in each class and write the program..	Netbeans IDE	Constructors and its types
6.	A child inherits the features of parents and also develops its own personality as it grows up in the society, over a period of time. This situation can be represented by the concept of multilevel inheritance in java programming. Apply the same concept in the car manufacturing scenario in your own terms. Note: Student should identify the classes, data and function members in each class and write the program.	Netbeans IDE	eritance

7	XYZ technologies is firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize its payroll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. Income Tax is 40% of gross salary for all employees. The annual increments to the employees are to be given of the following criteria: - Manager 10% of the basic salary, and Technicians 15% of basic. Develop the pay roll for XYZ. Implement a class	Netbeans IDE	Abstract classes and logic building
8	Define a new Exception class named Odd Exception. Create a new class named Even Odd. Write a method called halfOf(), which takes an int as parameter and throws an Odd Exception if the int is odd or zero, otherwise returns (int / 2). Write a main method that calls halfOf() three times (once each with an even int, an odd int, and zero), with three try/catch blocks, and prints either the output of halfOf() or the caught Odd Exception.	Netbean IDE	Exception handling
9	Implement a class named Fraction that represents fractions with numerator and denominator always stored reduced to lowest terms. If fraction is negative, the numerator will always be negative, and all operations leave results stored in lowest terms. Implement the addition, subtraction, multiplication and division operation for the Fraction class and also handle divide by zero using java exception handling mechanism.	Netbeans IDE	Exception handling

10	Create a class Student that has instance variables as Name, Age, Address and access transmutation methods to access the instance variables along with display method to print the details of student. Next write a main () function that will create a collection of 10 students and reverse the list. Print the details before and after reversing the collection.	Netbeans IDE	Logic building, classes and objects
11	Create a Shape interface having methods area () and perimeter (). Create 2 subclasses, Circle and Rectangle that implement the Shape interface. Create a class Sample with main method and demonstrate the area and perimeters of both the shape classes. You need to handle the values of length, breath, and radius in respective classes to calculate their area and perimeter.	Netbeans IDE	Interfaces
12	Create a class that contains a generic **map** with generic type parameters K & V passed in the declaration of **HashMap**. K represents key of type String and V represents value of type Integer. Add any 5 key/value pairs to Hashmap using function put() and retrieve the value using particular key using get() function and print the same. te: Map is an interface and HashMap is its implementing class.	Netbeans IDE	A Collection framework
13	Create a class that has a method that operates only on **Number** or its subclasses to calculate sum and product and print the	Netbeans IDE	JAVA Generics

SELF-LEARNING EXERCISES:

1. The Eclipse-IDE
2. Streams
3. Concurrent Programming
4. Swing and JavaFX
5. Networking- JDBC, Database Access

TEXT BOOKS:

3. Cay S. Horstmann, “Core Java® SE 9 for the Impatient”, Addison Wesley, Second Edition, 2018.
4. HerbertSchild, “Java™: TheCompleteReference”, McGraw-Hill, Tenth Edition,2018.
5. David Gallardo, Ed Burnette, Robert Mcgovern, “Eclipse in Action a guide for java developers”, Manning Publications, 2003.

6. Ed Burnette, “Eclipse IDE Pocket Guide: Using the Full-Featured IDE”, O'Reilly Media, Inc, USA, 2005.

REFERENCE BOOKS:

1. Cay S. Horstmann, “Core Java™ Volume I—Fundamentals”, Prentice Hall, Tenth Edition, 2015
2. Joshua Bloch, “Effective Java”,Addison-WesleyProfessional,ThirdEdition,2017
3. Ken Kousen, “Modern Java Recipes”, O'Reilly Media, Inc.,2017
4. Oracle Java Documentation. (https://docs.oracle.com/javase/tutorial/)

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/document/5464387
2. https://files.eric.ed.gov/fulltext/EJ1075126.pdf
3. https://www.sciencedirect.com/science/article/pii/S0167642304000590
4. https://www.informingscience.org/Publications/4322?Source=%2FJournals%2FJITEIIP%2FArticles%3FVolume%3D0-0
5. https://www.javadevjournal.com/
6. https://blogs.oracle.com/javamagazine/

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs84/preview
2. https://www.classcentral.com/course/swayam-programming-in-java-12930
3. https://swayam.gov.in/explorer?searchText=java

<table>
<tr><td>Course Title</td><td colspan="4">Digital Logic and Design lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0304</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

The Digital Logic and Design Lab course provides hands-on experience in designing, simulating, and testing digital circuits. Students will explore fundamental concepts such as Boolean algebra, combinational and sequential logic, and digital system design. The lab emphasizes practical skills using hardware description languages and digital simulation tools. By the end of the course, students will be adept at implementing and troubleshooting complex digital systems.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Design, build and test Combinational Digital logic circuits
2. Design, build and test Sequential Digital logic circuits
3. Simulate Combinational logic circuits using HDL.
4. Simulate Sequential logic circuits using HDL

COURSE OUTCOMES:

After successful completion of this course; student shall be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Design combinational Digital logic circuits for the given specification and test the design.	1,2,3,4,9,10,12	1,2,3
CO2	Design sequential Digital logic circuits for the given specification and test the design.	1,2,3,4,9,10,12	1,2,3
CO3	Use EVM technique to simplify the Boolean expression and implement the simplified expression using Multiplexers	1,2,3,4,9,10,12	1,2,3
CO4	Demonstrate the Xilinx tool usage for simulating Digital logic circuits described using HDL	1,2,3,4,9,10,12	1,2,3
CO5	Make use of Xilinx tool to Simulate combinational logic circuit	1,2,3,4,9,10,12	1,2,3
CO6	Make use of Xilinx tool to Simulate sequential logic circuits described using VHDL and verify the behavior	1,2,3,4,9,10,12	1,2,3

COURSE ARTICULATION MATRIX:

CO	Program Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	3					3	3		2	3	1	2
CO 2	3	3	3	3					3	3		2	3	1	2
CO 3	3	3	3	3					3	3		3	3	1	3
CO 4	2	3	3	3	3				3	3		3	3	1	3
CO5	2	3	3	3	3				3	3		3	3	1	3
CO6	2	3	3	3	3				3	3		3	3	1	3

SL.No	**List of Experiments**		**Tools**	**Expected Skills/Ability**
1.	a.	Realization of Basic gates using Universal Gates.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop VHDL code to realize Basic gates using Universal gates.	Trainer Kit/Xilink	Basic Electronics
2.	a.	Realization of Half adder and Full adder using logic gates.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop VHDL code to realize Half adder and Full adder.	Trainer Kit/Xilink	Basic Electronics
3.	a.	Realization of Full Subtractor using 3:8 decoder IC 74138.	Trainer Kit/Xilink	Basic Electronics
	b.	Realization of Half Subtractor using basic gates.	Trainer Kit/Xilink	Basic Electronics
4.	a.	Given a 4-variable logic expression, simplify it using Entered Variable Map and realizethe simplified logic expression using 8:1 multiplexer IC.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it'sworking.	Trainer Kit/Xilink	Basic Electronics
5.	a.	Realization of Master Slave JK flip flop truth table using IC 7476 and verify Delay andtoggle flip flop using MSJK flip flop IC.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop VHDL code for D and T Flip-Flop with positive-edge triggering.Simulate and verify it's working.	Trainer Kit/Xilink	Basic Electronics

6.		Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs anddemonstrate its working.	Trainer Kit/Xilink	Basic Electronics
7.	a.	Design and implement a ring counter using 4-bit shift register and demonstrate itsworking.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop VHDL code for Johnson counter. Simulate and verify it's working.	Trainer Kit/Xilink	Basic Electronics
8.	a.	Design and implement an asynchronous counter using decade counter IC 7490 to countup from 0 to n (n<=9) and demonstrate its working.	Trainer Kit/Xilink	Basic Electronics
	b.	Design and develop VHDL code for mod-8 up counter, Simulate and verify it's working.	Trainer Kit/Xilink	Basic Electronics
9		Design and develop VHDL code for 1-bit and 2-bit magnitude comparator, Simulate andverify it's working.	Trainer Kit/Xilink	Basic Electronics
10.		Design and develop VHDL code for 8 to 3 Encoder and 1:4 De-multiplexer, Simulate andverify it's working.	Trainer Kit/Xilink	Basic Electronics

TEXT BOOKS:

1. VHDL: Programming by Example, Douglas L. Perry, Fourth Edition.
2. D P Leach, A P Melvino, and Goutham Saha, Digital Principles and Applications, Tata McGraw-Hill,8th edition, 2006.
3. Digital Logic and Computer Design, MMorris Mano, PEA.

<table>
<tr><td>s</td><td colspan="4">Course based Project</td><td colspan="2">Course Type</td><td colspan="2">SDC</td></tr>
<tr><td>Course Code</td><td>B24EI0305</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

Course Overview:

This course emphasizes hands-on learning through a series of projects. Students will apply theoretical knowledge to practical tasks, developing skills in problem-solving, critical thinking, collaboration, and communication. The projects will cover various topics within the subject and will require students to use tools and techniques relevant to the field.

Course Objectives:

The objectives of this course are to:

1. Apply theoretical concepts to practical scenarios.
2. Develop project management and organizational skills.
3. Enhance problem-solving and critical thinking abilities.
4. Collaborate effectively with peers.
5. Communicate findings and results clearly.

Course Outcomes:

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3

CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Program description:

The objective of this course-based project is to implement and analyse several fundamental data structures and associated algorithms. This project aims to deepen understanding of data structures, their operations, time complexities, and practical applications.

List of Sample Projects:

1. Network Routing Algorithm

Problem Statement:

Develop a network routing algorithm to determine the most efficient path between nodes in a network, considering factors like distance, cost, and traffic congestion.

Implementation Description:

- **Graph Representation:** Represent the network as a graph where nodes represent routers or switches, and edges represent the connections between them. Use an adjacency list or matrix for the graph representation.
- **Data Structures:**
    - **Priority Queue:** Use a priority queue to manage nodes to be explored, with the priority being the cost or distance.
    - **Hash Maps:** Maintain a hash map for the shortest path estimates and another for the predecessor nodes to reconstruct the path.
- **Algorithm:** Implement Dijkstra's or A* algorithm to find the shortest path. The priority queue will help efficiently select the next node to explore based on the current shortest path estimate.

2. Information Retrieval System

Problem Statement:

Create an information retrieval system that indexes a collection of documents and allows for efficient search and retrieval of information based on user queries.

Implementation Description:

- **Inverted Index:** Build an inverted index to map terms to the documents containing them. This index will facilitate fast lookups.
- **Data Structures:**
    - **Trie:** Use a trie for efficient prefix searches and auto-completion of queries.
    - **Hash Map:** Store the inverted index using a hash map where keys are terms and values are lists of document IDs.
- **Search Algorithm:** Implement Boolean or vector space models for querying. Use TF-IDF for ranking the relevance of documents to the query.

3. Traffic Light Simulation at Cross Road

Problem Statement:

Simulate the operation of traffic lights at a busy crossroad, considering traffic flow and optimizing wait times.

Implementation Description:

- **Graph Representation:** Represent the crossroad as a graph with nodes as intersections and edges as roads.
- **Data Structures:**
    - **Queue:** Use queues to model the lanes and manage the flow of vehicles.
    - **Finite State Machine (FSM):** Use FSM to manage the states of traffic lights (red, yellow, green).
- **Algorithm:** Implement a traffic light control algorithm that adjusts light durations based on the traffic density in each direction.

4. Natural Language Understanding

Problem Statement:

Develop a system to understand and process natural language text, extracting meaningful information and responding to user queries.

Implementation Description:

- **Text Representation:** Use tokenization and parsing to represent the text.
- **Data Structures:**
    - **Trie:** For efficient storage and retrieval of vocabulary and phrases.
    - **Parse Tree:** Use parse trees to represent the grammatical structure of sentences.
- **Algorithm:** Implement natural language processing (NLP) techniques such as named entity recognition (NER), part-of-speech tagging, and sentiment analysis.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to Design Thinking</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24CI0309</td><td>Credit</td><td colspan="2">02</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credit</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>28</td><td>14</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world

In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To impart knowledge on design thinking process for understanding designs.
2. To provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. To inculcate attitude to solve societal problems using design thinking tools.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop problem solving skills.	1,2,9,10,12	1,2
CO2	Students will develop human-centric mindset while designing, innovating, developing, and testing solutions for new products, services, and processes	1,2,9,10,12	1,2
CO3	Enhance communication and understanding between the team members.	1,2,9,10,12	1,2
CO4	Enhance creative thinking and apply for solving real world problems.	1,2,9,10,12	1,2
CO5	Understand the role of innovation in the digital era and drive disruptive innovation.	1,2,3,5,9,10	1,2
CO6	Develop the ability to create and test prototypes that are customer-centric and innovative	1,2,3,4,5,9,10	1,2

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓	✓				
CO4	✓	✓	✓			✓
CO5	✓	✓				✓
CO6	✓	✓			✓	

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	2	
CO2	1	3							2	3		2	1	2	
CO3	1	2							3	2		3	1	2	
CO4	1	2							3	2		2	1	2	
CO5	2	2	3		2				3	3		2	2	3	
CO6	2	2	2	2	2				3	2		2	2	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENTS: THEORY:

Design Thinking Process: Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc, identifying the target users for the problem selected, Survey on existing solutions for the problem identified.

Empathizing: Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies.
Defining the problems: POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc
What is a prototype? - Prototyping as a mind set, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype
Prototyping for digital products: What’s unique for digital, Preparation; Prototyping for physical products: What’s unique for physical products, Preparation; Testing prototypes with users.

PRACTICE:

Sl.No	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human cantered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop ma perception king problem statements from user
6	Presentation by student teams	PPT	Develop ability to express their views

Course Title	**Technical Documentation**				**Course Type**		**FC**	
Course Code		**Credits**	**1**		**Class**		**III Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**1**	**1**	**1**				
	Tutorial	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	**-**	**-**	**-**				
	Total	**1**	**1**	**1**	**14**	**-**	**25**	**25**

COURSE OVERVIEW:

Technical writing is all about strategically placing facts and figures in a sensible and user-understandable way. A structured approach encourages creating a better output, all the while considering available resources and objectives. This course focusses on various factors to improve the skills of Technical documentation.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Acquire language skills
2. Develop linguistic and communicative competencies
3. Study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE OUTCOMES (COs):

After successful completion of this course; the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Produce effective engineering documents that enable readers to access relevant information.	6,8,9,10,12	**1**
CO2	Learn to avoid communication problems that distract the readers, causing confusions, distrust, or misunderstanding.	6 8,9,10,12	**1**
CO3	Practice various verbal reasoning and grammar practice.	6,8,9,10,12	**1**
CO4	Search engineering information, both in traditional ways and online.	6,8,9,10,12	1
CO5	Write research/design reports with special emphasis on content and style.	6,8,9,10,12	1
CO6	Improve the art of presentations in team	6,8,9,10,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2	√	√	√			
CO3		√				
CO4		√				
CO5		√	√			
CO6		√	√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1		1	2	2		2	1		
CO2						1		1	2	2		2	1		
CO3						1		1	2	2		2	1		
CO4						1		1	2	2		2	1		
CO5						1		1	2	2		2	1		
CO6						1		1	2	2		2	1		

Note:1-Low,2-Medium,3-High

COURSECONTENTS:

THEORY:

Information Design and Development- Different kinds of technical documents, Information development life cycle, factors affecting information and document design, Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.

Advanced Technical Communication : Introduction to advanced technical communication, Usability, Managing technical communication projects, time estimation, Single sourcing, Localization, Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

TEXT BOOKS:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4.Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5.Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6.Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).

<table>
<tr><td>Course Title</td><td colspan="4">Indian Constitution and Cyber law</td><td colspan="2">Course Type</td><td colspan="2">MC</td></tr>
<tr><td>Course Code</td><td></td><td>Credits</td><td colspan="2">0</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course
Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>-</td><td>1</td><td>1</td><td>14</td><td>-</td><td>-</td><td>-</td></tr>
</table>

COURSE OVERVIEW:

The Constitution of India lays down in defining fundamental political principles, establishes the structure, procedures, powers and duties of government institutions and sets out fundamental rights, directive principles and duties of citizen. It helps to know and understand state executive and elections system of India.

COURSE OBJECTIVES

The objectives of this course are to:

1. Know about the basic structure of Indian Constitution.
2. Know the Fundamental Rights (FR’s), DPSP’s and Fundamental Duties (FD’s) of our constitution.
3. Know about our Union Government, political structure & codes, procedures.
4. Know the State Executive & Elections system of India.
5. Learn the Amendments and Emergency Provisions, other important provisions given by the constitution

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO	**Course Outcomes**	**Pos**	**PSOs**

CO1	Analyse the basic structure of Indian Constitution	6,8,9, 12	
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution	6,8,9, 12	
CO3	Know about Indian Union Government, political structure & codes, procedures.	6,8,9, 12	
CO4	Understand our State Executive & Elections system of India	6,8,9, 12	
CO5	Understand the Amendments and Emergency Provisions, other important provisions given by the constitution	6,8,9, 12	
CO6	Understand constitutional amendments till today	6,8,9, 12	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1				√		
CO2		√				
CO3		√				
CO4		√				
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1						2		1	1			1			
CO2						2		1	1			1			
CO3						2		1	1			1			
CO4						2		1	1			1			
CO5						2		1	1			1			
CO6						2		1	1			1			

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Indian Constitution: Necessity of the constitution, societies before and after the constitution adoption, introduction to the Indian constitution, making of the constitution, role of the constituent assembly.

Salient features of India Constitution: Preamble of Indian constitution and key concepts of the preamble, fundamental rights and its restriction and limitations in different complex situations.

DPSP's and Fundamental Duties: Directive Principles of State Policy (DPSP's) and its present relevance in Indian society, fundamental duties and its scope and significance in nation, union executive: parliamentary system, union executive – president, prime minister, union cabinet.

Executive and Elections system of India: Parliament - LS and RS, parliamentary committees, important parliamentary terminologies, judicial system of India, supreme court of India and other courts, judicial reviews and judicial activism, state Executive and Governer, CM, state cabinet, legislature - VS & VP, election commission, elections and electoral process, amendment to constitution, and important constitutional amendments till today, emergency provisions.

TEXT BOOKS

1. Kapoor, S.K., "Human rights under International Law and Indian Law", Prentice Hall of India, New Delhi, 2002.

2. Basu, D.D., "Indian Constitution", Oxford University Press, New Delhi, 2002.

REFERENCES BOOKS

1. M V Pylee, "An Introduction to Constitution of India", S Chand & Company, 5th Edition.

2. Durga Das Basu, "Introduction to constitution of India", LexisNexis, 23rd Edition.

<table>
<tr><td>Course Title</td><td colspan="4">AEC-1 (Ability Enhancement Course - Placement Training)</td><td colspan="2">Course Type</td><td colspan="2">AEC</td></tr>
<tr><td>Course Code</td><td>B24EF0308</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW

Placement training classes can effectively be conducted as a part of an Ability Enhancement Course (AEC). These courses are designed to enhance students' skills, making them more prepared and competitive for the job market.

IV Semester													
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EH0401	Optimization Techniques	FC	3	0	0	3	3	50	50	100	BSC
2	B24EF0401	Design and Analysis of Algorithms	HC	3	0	0	3	3	50	50	100	PCC
3	B24EF0402	Computer Organization and Architecture	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0401	Database Management Systems	HC	3	0	0	3	3	50	50	100	PCC
5	B24EI0402	Embedded Systems for IoT	HC	3	0	0	3	3	50	50	100	PCC
6	B24EIS41X	Professional Elective-2	SC	3	0	0	3	3	50	50	100	PEC
7	B24EF0405	Design and Analysis of Algorithms Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EF0406	Microcontroller and IOT Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0403	Database Management Systems Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EI0404	Course based Project	SDC	0	0	1	1	2	25	25	50	Proj
11	B24-	Professional Ethics	FC	1	0	0	1	1	25	25	50	HSMC
12	B24-	Universal Human Values	HC	1	0	0	1	1	25	25	50	HSMC
13	B24-	Environmental Science	MC	1	0	0	0	1				HSMC
14	B24EF0409	AEC-2(Ability Enhancement Course) (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				**21**	**0**	**5**	**25**	**31**	**475**	**475**	**950**	

TOTAL SEMESTER CREDITS	**25**
TOTAL CUMULATIVE CREDITS	**89**
TOTAL CONTACT HOURS	**31**
TOTAL MARKS	**950**

<table>
<tr><td>Course Title</td><td colspan="4">Optimization Techniques</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td>B24EH0401</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

The optimization techniques course covers mathematical methods for finding optimal solutions to problems with constraints, focusing on both linear and nonlinear systems. It includes algorithms like gradient descent, simplex method, and genetic algorithms. Practical applications span engineering, economics, and operations research. The course also explores software tools and real-world case studies to illustrate concepts.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Establish a solid foundation in the basic concepts and types of optimization problems.
2. Acquire proficiency in classical optimization techniques, including linear and nonlinear programming.
3. Understand and analyze the mathematical properties of optimization problems, focusing on convexity and concavity.
4. Investigate and apply modern optimization techniques to solve complex real-world problems.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Identify and classify various optimization problems.	1,2,5,6	1,2,3
CO2	Formulate linear and nonlinear optimization models for practical problems	1,2,5,6	1,2,3
CO3	Solve linear programming problems using graphical methods, the Simplex method, and the Two Phase method	1,2,5,6	1,2,3
CO4	Analyze the properties of convex and concave functions using the Hessian matrix and eigenvalues	1,2,5,6	1,2,3
CO5	Apply appropriate techniques to solve single and multivariable nonlinear optimization problems	1,2,5,6	1,2,3
CO6	Utilize modern optimization techniques such as genetic algorithms and simulated annealing for solving complex problems	1,2,5,6	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√				
CO3			√			
CO4				√		
CO5			√			
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3	2							3	3	3
CO2	3	2			3	2							3	3	3
CO3	3	2			3	2							3	3	3
CO4	3	2			3	2							3	3	3
CO5	3	2			3	2							3	3	3
CO6	3	2			3	2							3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Optimization Techniques: Overview of optimization problems- unconstrained vs. constrained, Single variable vs multivariable Optimization. Types of optimizations - linear, nonlinear, discrete, continuous. Linear Programming: Formulation of linear programming problems, Graphical method for solving LP problems, Simplex method and its applications, Two Phase method.

Convex Functions, Definition and Basic Properties, First-order and Second-order Conditions, Epigraph and Sublevel Sets. Concave Functions, Definition and Basic Properties, First-order and Second-order Conditions, Hypograph and Superlevel Sets. Hessian Matrix and Eigenvalues: Computation of Hessian Matrix, Eigenvalues and Definiteness, Using Eigenvalues to Determine Convexity or Concavity. Bordered Hessian Matrix- Second-order Conditions for Constrained Optimization. convex optimization problems, Quadratic Programming.

Introduction to nonlinear optimization problems, Types of nonlinear programming problems, Single variable optimization: Unimodal Function, Elimination Methods- Unrestricted search, Exhaustive Search. Multivariable optimization with no constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality constraints.

Unconstrained Optimization Techniques: Introduction, Direct Search Methods, Random Search Methods, Indirect search(Descent) methods, Gradient of a function, Steepest Descent(Cauchy) Method, Newton's Method.

Modern Methods of Optimization: Introduction, Genetic Algorithms-Use case, Simulated Annealing- Use case, Particle Swarm Optimization- Use case, Ant Colony Optimization- Use case, Optimization of Fuzzy Systems- Use case, Neural-Network-Based Optimization- Use case.

TEXT BOOKS:

1. Singiresu S. Rao,” Engineering Optimization – Theory and Practices”, JohnWiley & Sons, 4th Edition, 2009
2. Operations research, theory and applications: J K Sharma
3. Convex Optimization: Stephen Boyd, Lieven Vandenberghe

REFERENCE BOOKS:

1. Operations Research Theory, Methods and Applications, S D Sharma, 2020
2. Introduction to Operations Research, 11th Edition, by Frederick S. Hillier, Gerald J. Lieberman, et al., 2021
3. Operations Research: An Introduction, 10e by Hamdy A. Taha
4. Multi-Objective Optimization using Evolutionary Algorithms, Kalyanmoy Deb, ISBN: 978-0-471-87339-6, July 2001

JOURNALS/MAGAZINES:

1. **https://link.springer.com/book/10.1007/978-1-84996-129-5**
2. **https://link.springer.com/book/10.1007/978-0-387-36797-2**
3. **https://link.springer.com/book/10.1007/978-3-319-91578-4**

SWAYAMNPTEL/MOOCs

1. **https://nptel.ac.in/courses/111105039**
2. **https://archive.nptel.ac.in/courses/106/108/106108056/**
3. **https://nptel.ac.in/courses/106106245**

<table>
<tr><td>Course Title</td><td colspan="4">Design and Analysis of Algorithms</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0401</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

Pre-requisites: Programming with C, Data Structures.

COURSE OVERVIEW:

It is a conceptual course which gives insight to the students about different algorithm design techniques. Understanding the fundamental concepts of writing algorithms for the given problem using appropriate algorithmic design technique and analyzing for its time complexity makes students to develop problem solving skill sets and coding methodology. This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. Deals with analyzing Time and Space complexity of algorithms and to evaluate trade-offs between different algorithms.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Develop a solid understanding of fundamental concepts in algorithm design, analysis, and data structures.
2. Enhance problem-solving skill sets and strategies for designing efficient algorithms.
3. Learn techniques for analysing the efficiency of algorithms, including Time and Space complexity analysis.
4. Evaluate the learnt concepts and techniques to solve a variety of complex problems using different algorithms.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Understand of fundamental algorithmic concepts	1, 2, 3, 5, 9,12	1,2,3
CO2	Design efficient algorithms and solve a variety of problems	1, 2, 3, 5, 9,12	1,2,3
CO3	Develop the skills to analyze the time complexity and space complexity of algorithms.	1, 2, 3, 5, 6, 9, 12	1,2,3
CO4	Analyze different algorithmic techniques and data structures to solve the problems efficiently.	1, 2, 3, 5, 6, 9, 12	1,2,3
CO5	Apply the knowledge and skills to solve problems that require algorithmic solutions	1, 2, 3, 5, 6, 9,12	1,2,3
CO6	Evaluate the algorithms for real time complex problems.	1, 2, 3,4, 5, 6, 9,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√	√		
CO3			√	√		
CO4				√		
CO5			√		√	
CO6			√	√	√	

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1								3	3	
CO2		3			2							2	3	3	
CO3		2	3		3							2	3	3	3
CO4		2	2		2							2	3	3	
CO5			3		3				2			2	3		3
CO6			3	2	2				2			3		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Introduction to Analysis of Algorithm Efficiency: Notion of an Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types. Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms.

Brute Force Approach: Bubble Sort, Selection Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search. Decrease-and-Conquer: Topological Sorting. Divide-and-Conquer: Merge sort, Quick sort. Transform and Conquer: Heaps and Heap sort.

Space and Time Trade-Offs: Sorting by Counting, Input Enhancement in String Matching Hashing: Open and Closed Hashing. Dynamic Programming: The Knapsack Problem and Memory Functions, Optimal Binar Search Trees, Warshall's and Floyd's Algorithms. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

Backtracking: N-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem, Branch-and-Bound-Assignment Problem, Knapsack Problem, Travelling Salesman Problem, Basic concepts of deterministic and non-deterministic algorithms, P, NP, NP-Complete and NP-Hard problems.

Self Learning Component:

Bellman Ford Algorithm, Longest Common Subsequence, Multi-Stage Graph, Matrix Chain Multiplication, Naïve String Matching, Rabin Karp Algorithm, Knuth-Morris-Pratt (KMP) Algorithm.

TEXT BOOKS:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd edition, Pearson Education, 2017.
2. Ellis Horowitz, Satraj Sahni and Rajasekaran,Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd edition, PHI Learning Private Limited, 2017.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson.
3. Donald E. Knuth, “The Art of Computer Programming”, Volumes 1and 3 Pearson.

JOURNALS/MAGAZINES:

1. ACM Transactions on Algorithms.
2. ACM Journal of Algorithms and Computational Technology.

SWAYAMNPTEL/MOOCs:

1. NPTEL Course on “Design and Analysis of Algorithms”, Prof. Abhiram G Ranade, Prof. Ajit A Diwan and Prof. Sundar Vishwanathan
https://nptel.ac.in/courses/106101060

2. Udemy Course on “Design and Analysis of Algorithms”, shravan Kumar Manthri
https://www.udemy.com/course/design-and-analysis-of-algorithms/?couponCode=IND21PM

<table>
<tr><td>Course Title</td><td colspan="4">Computer Organization and Architecture</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0402</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2">39</td><td colspan="2"></td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Computer organization and architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate to implement the architectural specification. In this course, students will learn the basics of hardware components from basic arithmetic units to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Write simple programming constructs and programs using assembly language.
2. Understand the translation of assembly instructions into their binary representation.
3. Describe and understand the processor memory hierarchy.
4. Provide basic understanding of interrupts, I/O devices, and I/O protocols

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe architecture of ARM processor and write simple assembly programs.	1,2,7,12	
CO2	Interpret the functional architecture of computing systems.	1,2,4,10	
CO3	Identify, compare and assess issues related to ISA, memory, control and I/O functions.	1,11	1,2
CO4	Illustrate how interrupts are used to implement I/O control and data transfers.	1,2,4,10,11	
CO5	Analyze and Implement Vector (SIMD) Processing.	1,2,4,10	
CO6	Design and analyze solutions in computer architecture.	1,11	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√		√		
CO3		√		√		
CO4		√	√			
CO5		√	√	√		
CO6		√	√	√		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3					3					1			
CO2	3	3		2						2					
CO3	3										2		2	2	
CO4	3	3		2						2	2				
CO5	3	3		2						2					
CO6	3										2		2	2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Introduction to ARM processor: Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer and Internet of Things (IoT). ARM characteristics, Register structure, Addressing modes, Instructions, Assembly language, Operating Modes and Exceptions, Conditional execution of Instructions.

Arithmetic unit: Addition and Subtraction of Signed Numbers**,** Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations, Arithmetic operations on floating point numbers.

Memory System: Basic concepts, Synchronous RAM memories, Read-only memories, Direct Memory Access, Memory Hierarchy, Cache memories, Virtual memory.

Input/output Organization: Bus structure, Bus operation, Arbitration, Interface circuits, Intercommunication standards.

Parallel processing: Hardware multithreading, Vector (SIMD) processing and Shared Memory multiprocessors.

SELF-LEARNING COMPONENT:

Intel IA-32 architecture, Instruction Set Architecture, Basic Input/Output, Basic processing unit and Pipelining.

TEXTBOOKS:

1. Carl Hamacher , Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, McgraHIll.

REFERENCE BOOKS:

1. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
2. Andrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc.

JOURNALS/MAGAZINES:

1. IEEE Computer Architecture letters
   https://www.computer.org/csdl/journal/ca

2. ACM SIGARCH Computer Architecture News
   https://dl.acm.org/newsletter/sigarch

SWAYAMNPTEL/MOOCs

1. NPTEL Course on Computer Organization and Architecture
   https://archive.nptel.ac.in/courses/106/105/106105163/

Course Title	**Database Management Systems**				**Course Type**		**HC**	
Course Code	**B24EI0401**	**Credits**	**3**		**Class**		**IV Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	3	3	3	42	-	**50**	**50**

COURSE OVERVIEW:

This course provides an introduction to the fundamental concepts of database and database management systems with the primary objective of equipping the students with the ability and skills to build and manage a real-world database effectively. It covers the important topics of the database approach, its characteristics, significance, types of data models, conceptual data modeling, database design theory and normalization. It renders a comprehensive section for SQL, the standard for relational database management systems that supports query languages for data definition as well as data manipulation. It also briefly introduces the important concepts of database transactions, ACID properties, and concurrency control and error recovery to impart their significance for successful management of commercial databases. This course is intended to provide the students with necessary basic knowledge and skills in the domain of database management systems with special focus on relational databases to gain an understanding of real-world requirements of maintaining a database system. The knowledge gained by this course can be used to explore advanced database systems in future.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Database and Database Management System required to build and maintain real-world commercial database applications.
2. Demonstrate the theory behind Relational data model and Relational algebra as a case study and understand the organization of data therein and the kind of operations applicable to it.
3. Illustrate the capabilities of database query languages using SQL for data definition, data manipulation, and view definition and transaction control.
4. Describe the process of database design using normalization and introduce the concepts of multi-user transaction processing, concurrency control and error recovery in real-world database systems.

COURSE OUTCOMES (COs) :

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 9,10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,9,10,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5, 9,10,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1 to 5, 9,10,12	1,2
CO5	Understand the need and significance of multi-user transaction processing, concurrency control and error recovery for commercial database applications.	1 to 5, 9,10,12	1,3
CO6	Relate conceptual model to relational model and formulate relational algebra Queries.	1 to 5, 9,10,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2	√	√	√			
CO3			√			
CO4			√	√		
CO5			√	√		
CO6	√	√	√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				3	3		1	3	3	
CO2	3	3	2	3	1				3	3		1	3	3	
CO3	3	3	2	3	3				3	3		1	3	3	3
CO4	3	3	2	3	1				3	3		1	3	3	
CO5	3	2	3	3	3				3	3		1	3		3
CO6	3	3	2	3	3				3	3		1		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to databases and Conceptual Modelling: Introduction to database, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues. Introduction to various database tools and framework (commercial and open source)

Relational Data Model and Relational algebra: Relational model concepts, relational model constraints and relational database schemas, update operations, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra.

SQL:SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, Retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.

Database Design Theory, Normalization, and Transaction Processing: Informal design guidelines for relation schemas, Functional dependencies, and Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms. Introduction to Transaction Processing, Single-User versus Multiuser Systems, Why Concurrency Control Is Needed, Why Recovery Is Needed, Desirable Properties of Transactions (ACID Properties)

SELF-LEARNING COMPONENT:

1. NoSQL databases
2. MONGODB
3. Transaction and concurrency control
4. UML

TEXT BOOKS:

i. Elmasri and Navathe,"Fundamentals of Database Systems", Pearson Education, 5th Edition, 2007.
ii. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill, 3rd Edition, 2003.
iii. Phill Pratt, "Concepts of Database Management, Cengage Learning", 8th Edition, 2014
iv. Jeffrey A Hoffer, "Modern Database Management, Pearson", 12th Edition, 2015
v. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book,2nd Ed., Prentice-Hall, 2008.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: "Database System Concepts", 6th Edition, McGraw Hill, 2010.
2. C J Date, "Database Design and Relational Theory: Normal Forms and All that Jazz", O 'Reilly, April 2012.
3. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering
5. Elsevier Data and Knowledge Engineering
6. ACM Transactions on Database Systems

JOURNALS/MAGAZINES:

1. http://www.ijstr.org/final-print/june2019/Database-Management-System.pdf
2. https://www.dbjournal.ro/

SWAYAMNPTEL/MOOCs

1. https://www.coursera.org/courses?query=database%20management
2. https://onlinecourses.swayam2.ac.in/cec19_cs05/preview
3. https://www.edx.org/learn/databases
4. https://www.classcentral.com/course/swayam-data-base-management-system-9914

Course Title	**Embedded Systems for IoT**				**Course Type**		HC	
Course Code	**B24EI0402**	**Credits**	3		**Class**		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	42	**-**	**50**	**50**

COURSE OVERVIEW:

The explosive growth of the “Internet of Things” is changing our world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products at home. In this course Embedded systems, IoT, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the Embedded Systems and IoT.
2. Demonstrate the Design and Choosing of the components HW platforms.
3. Illustrate the use of Basics of Networking, Machine-to-Machine interaction.
4. Demonstrate the insights of accessing data from a Cloud frame work

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the embedded systems form the foundation of both cyberphysical systems and IoT devices.	1 to 5,9 10,12	1,2,3
CO2	Apply the models of computation to analyze and understand embedded systems.	1 to 5,9 10,12	1,2,3
CO3	Make use of the concept of hardware selection process interconnected with the software and overall system design.	1 to 5,9 10,12	1,2,3
CO4	Demonstrate networking, M2M interaction, and IoT communication that enable the seamless functioning of devices.	1 to 5,9 10,12	1,2,3
CO5	Build cloud computing paradigm of computing that involves the delivery of computing services over the internet ("the cloud") to users and organization.	1 to 5,9 10,12	1,2,3
CO6	Apply your knowledge of embedded systems and IoT to address complex challenges and opportunities in this interdisciplinary field.	1 to 5,9 10,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		●				
CO2			●			
CO3			●			
CO4		●				
CO5			●			
CO6			●			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				3	3		1	3	3	
CO2	3	3	2	3	1				3	3		1	3	3	
CO3	3	3	2	2	2				3	3		1	3	3	3
CO4	3	3	2	3	1				3	3		1	3	3	
CO5	3	3	2	2	2				3	3		1	3	3	3
CO6	3	3	2	3	1				3	3		1	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Embedded Systems and IoT:
Introduction to microprocessors and micro controllers, 4,8-,16- and 32-bit microcontrollers, application areas, examples, Common characteristics, Challenges and design flows, Modeling of Embedded Systems - Requirements, models of computation, Finite State Machines, Timed Automata, State Charts, Modeling of Hierarchy; Data flow modeling , Discrete Event Modeling , Continuous and Discrete time system concepts.

Design - Choosing the components HW platforms - Processors, Sensors, Actuators; SW stack – RTOS, Scheduling Real Time control tasks, IoT Fundamentals - Devices, Gateway; Elements of IoT - IoT Functional blocks, IoT Communication Modules and API.

Basics of Networking: Machine-to-Machine interaction, IoT Communication Protocols MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Concept of Cloud Computing: Everything as a Service (XaaS), Role of Cloud; Software Components - Programming API's; IoT Application Development - Solution Framework for IoT, Fault Tolerance in IoT based Systems.

SELF-LEARNING COMPONENT:

https://iies.in/blog/what-are-the-best-methods-for-self-learning-embedded-systems/

TEXT BOOKS:

1. Peter Mardwel, Embedded System Foundations of Cyber Physical Systems Springer 2nd Edition.
2. Rajeev Alur, Principles of Cyber-Physical Systems.

REFERENCE BOOKS:

1. Pethuru Raj and Anupama C. Raman (CRC Press). The Internet of Things : Enabling Technologies, Platforms and Use Cases.
2. Arshdeep Bagha and Vijay Madisetti Internet of Things: A Hands-on Approach.

JOURNALS/MAGAZINES:

https://www.inderscience.com/jhome.php?jcode=ijes

SWAYAMNPTEL/MOOCs

Introduction to the Internet of Things and Embedded Systems Course by University of California, Irvine | Coursera

Professional Electives II:

Course Title	**Microcontrollers**				**Course Type**		**SC**	
Course Code	**B24EIS411**	**Credits**	3		**Class**		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	42	**-**	**50**	**50**

COURSE OVERVIEW:

This course provides a overview of microcontrollers in order to study from basics of programming to interface the microcontroller with different interfacing units to operate as a equipment in any embedded sysstems.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Introduce to the world of microcontrollers for implementing real world problems.
2. Learn the basic operations like arithmetic, logical and data movement of Intel 8051 based microcontroller.
3. Study the assembly programming instruction to write a code in 8051 based microcontroller.
4. Prepare applications using keyboard, display using 8051 based microcontroller

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study the concepts of microcontroller for real world problems.	1-5	1-3
CO2	Learn the assembly level coding of 8081 microcontroller.	1-5	1-3
CO3	Comprehend the architectures and programming of 8051 microcontroller.	1-5	1-3
CO4	Learn the applications and usage of arithmetic, logical and data movement instructions.	1-5	1-3
CO5	Use the interfacing of keyboards and display with 8051 microcontroller	1-5	1-3
CO6	Develop real time projects using microcontroller and micorprocessors	1-5	1-3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√				
CO3		√				
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2								2	2	2
CO2	2	2	2	2	2								2	2	2
CO3	2	2	2	2	2								2	2	2
CO4	2	2	2	2	2								2	2	2
CO5	3	3	3	3	3								3	3	3
CO6	3	3	3	3	3								3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

INTRODUCTION TO MICROCONTROLLER A. Microprocessor and microcontroller, Features and architecture of 89C51 microcontroller, Addressing modes , Instruction set. B. Features and architecture of 89V51RD2 microcontroller.

ON CHIP PERIPHERALS OF 89C51 A. Port structure, Timers and counters, Serial port, Interrupt structure and simple assembly language programs B. On chip peripherals of 89V51RD2(PCA with PWM, Timers and counters, Interrupts etc)

SERIAL AND PARALLEL PORT INTERFACING A. Interfacing of display devices like LED, Seven segment, 2 x 16 character LCD (8bit mode),serial communication protocols-RS232, RS485, Buses-I2C and its implementation , SPI. B. Interfacing of 2 x 16 character LCD in 4 bit mode, alphanumeric display

INTERFACING AND PROGRAMMING USING EMBEDDED C A. 4 X 4 matrix keypad, DAC(Binary weighted and R2R ladder), ADC(Dual slope and Successive approximation type), Stepper motor(Unipolar, permanent magnet) B. Interfacing of relay, temperature sensor, DC & servo motor.

SELF LEARNING COMPONENT:

1. 8051 microcontrollers based embedded systems design.

2. Learn the architecture and working of ARM processors,.

Text Book(s)

1. 8051 and Embedded C programming‟- Mazidi and Mazidi, Second edition, Pearson education
2. 8051 microcontroller Architecture, programming and Applications- Kenath Ayala, third edition, Peneram publication .

Reference Books

1. Muhammad Ali Mazidi, ARM Assembly Language Programming & Architecture: 1,
2016, 2nd Edition, Microdigitaled.com

JOURNALS/MAGAZINES:

1. **Microprocessors and Microsystems: Embedded Hardware Design (MICPRO)**
2. **Microprocessors and Microsystems**

SWAYAMNPTEL/MOOCs

1. **Microprocessors and Interfacing**
2. **Microprocessors And Microcontrollers**

Course Title	**Foundation to Cybersecurity**				**Course Type**		**SC**	
Course Code	**B24EIS412**	**Credits**	**3**		**Class**		**IV**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes** **Per Semester**		**Assessment Weightage**	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	42	-	50	50

COURSE OVERVIEW:

This course enables the students to gain knowledge on various Cybercrimes. The course briefs the students regarding the global perspective of Cybercrimes, Cyber stalking, key loggers, crimes. The knowledge gained in this course can be applied to identify, classify, estimate the criminal plans of the attackers and predict the web threats and security implications.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Introduce the fundamentals of various cyber threats and attacks.
2. Acquaint with the knowledge about various security tools.
3. Understand IT security processes and technologies.
4. Awareness on cyber security industry standards.
5. Perception of securing devices and Internet security perimeter

COURSE OUTCOMES (COs) :

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Examine about incident response best practices and firewall implementations	1,2,3,4,5,6,7,12	1,2
CO2	Understand various Cyber security key terms and Internet security threats	1,2,3,4,5,6,7,12	1,2
CO3	Awareness on various cyber security frameworks and industry standards	1,2,3,4,5,6,7,12	1,2,3
CO4	Knowledge about security perimeter construction	1,2,3,4,5,6,7,12	1,2,3
CO5	Outline the business Process Management and access control methodologies	1,2,3,4,5,6,7,12	1,2
CO6	Apply basic endpoint protection strategies, including antivirus and antimalware tools	1,2,3,4,5,6,7,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2		✓				
CO3		✓				
CO4		✓				
CO5			✓			
CO6			✓			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	1	2					2	2	2	
CO2	2	2	2	2	2	2	2					2	2	2	
CO3	2	2	2	1	2	2	1					2	2	2	1
CO4	2	1	2	2	1	2	2					2	2	2	1
CO5	2	2	2	1	2	2	1					2	2	2	
CO6	2	2	2	2	2	2	2					2	2	2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Cybersecurity

Cybersecurity Definition, Key Terms, Security Threats, Vulnerability Assessments, Roles in Security, Cybersecurity Today, Critical Thinking in Cybersecurity Overview of actors and their motives: Hacking organizations, Major types of cyber-attacks, Network Security Model, Security services, Security Mechanisms, Threat Examples, Malware and Ransomware, Threat Protection, Internet Security Threats, Security Threat, The Cyber Kill Chain, Social Engineering, Cyberwarfare.

Overview of key security concepts

CIA Triad, Non - Repudiation - How does it apply to CIA? Access Management, Key Concepts – Incident Response, Incident Response Process, Introduction to Frameworks and Best Practices, IT Governance Process, Cybersecurity Compliance and Audit Overview. Overview of key security tools: Introduction to Firewalls, Firewalls - Packet Filtering, Firewalls – Application Gateway, Firewalls - XML Gateway, Firewalls - Stateless and Stateful, Antivirus/Antimalware.

Overview of People, Process and Technologies

What is IT Security? Frameworks and their purpose, Roles in Security, Introduction to Process, Overview Business Process Management. Overview of Information Technology Infrastructure Library (ITIL), Key ITIL Processes, identification and AAA, Access Control Methods, Access Control - Physical and Logical, Open Web Application Security Project (OWASP).

Compliance Frameworks and Industry Standards

What Cybersecurity Challenges do Organizations Face? Compliance Basics, Overview of US Cybersecurity Federal Law, National Institute of Standards and Technology (NIST) Overview, General Data Protection Regulation (GDPR) Overview, International Organization for Standardization (ISO) 2700x, SOC Reports, SOC Reports - Auditor Process Overview, Health Insurance Portability and Accountability Act (HIPAA), Payment Card Industry Data Security Standard (PCI DSS), Center for Internet Security (CIS) Critical Security Controls. Client System Administration, Endpoint Protection, Endpoint Detection and Response, Unified Endpoint Management, Overview of Patching, Windows Patching.

Securing the perimeter

Perimeter Security in the Real World, Security Challenges, The Basics of Internet Security, Understanding the Environment, Hiding the Private Network, Understanding Private Networks, Protecting the Perimeter, Understanding the Perimeter, Network Appliances, Proxy Servers, Demilitarized Zones (DMZs), Honeypots, Extranets.

Self-Learning Component:

Secure development lifecycle (SDLC), Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), Network Access Control (NAC), Network segmentation and isolation

TEXTBOOKS:

1. **Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Cyber Security Essentials 1/e, Sybex Wiley, 2019.**
2. **Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition**

REFERENCE BOOKS:

1. **B.B.Gupta, D.P.Agrawal, Haoxiang Wang, Computer and CyberSecurity: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.**
2. **James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, 1/e, CRC Press, 2011.**
3. **Chwan-Hwa(John) Wu, J. David Irwin, Introduction to Cyber Security, 1/e, CRC Press T&F Group, 2013**

JOURNALS/MAGAZINES:

1. **Journal of Cybersecurity and Information Management**
2. **Journal of Cybersecurity and Privacy**
3. **International Journal of Information Security**
4. **International Journal of Information Security and Cybercrime**
5. **International Journal of Cybersecurity Intelligence and Cybercrime**
6. **International Journal of Cyber Security**

SWAYAMNPTEL/MOOCs

1. https://www.coursera.org/learn/foundations-of-cybersecurity
2. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
3. https://onlinecourses.nptel.ac.in/noc24_cs121/preview
4. https://www.udemy.com/topic/cyber-security/
5. https://www.udemy.com/course/cybersecurity-from-beginner-to-expert/?couponCode=IND21PM
6. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks/home/week/1
7. https://www.coursera.org/learn/cybersecurity-roles-processes-operating-system-security/home/week/1
8. https://www.coursera.org/learn/cybersecurity-compliance-framework-system

Course Title	**Python Programming**				**Course Type**		**SC**	
Course Code	**B24EIS413**	**Credits**	**3**		**Class**		**IV Semester**	
	LTP	Credits	Contact Hours	Work Load	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	3	3	3	**42**	-	**50**	**50**

COURSE OVERVIEW:

This course introduces Python Programming fundamental components. Students are introduced to data structures, strings and file handling. This course includes an overview of Exception handling and Object-Oriented Programming Principles. In the course we also discuss useful python libraries such as numpy, pandas and matplotlib.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Learn the syntax and semantics of the Python programming language.
2. Illustrate the process of structuring the data using collections.
3. Demonstrate the use of built-in functions to navigate the file system.
4. Demonstrate the use of string in-built functions to work with text data.
5. Illustrate exception handling and Object-Oriented Programming concepts in Python.
6. Outline the usage of python libraries for working with arrays, data sets and representing data in the form of graphs/plots.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Illustrate basic python syntax and semantics.	1,2,3,4,5,12	1, 2, 3
CO2	Identify and use different data types and data structures in Python, such as lists, tuples, dictionaries, and sets.	1,2,3,4,5,12	1, 2, 3
CO3	Develop programs to handle a wide variety of tasks in Python programming that involve text and string data.	1,2,3,4,5,12	1, 2, 3
CO4	Demonstrate reading from and writing to files using Python.	1,2,3,4,5,12	1, 2, 3
CO5	Illustrate exception handling and outline the principles of object-oriented programming.	1,2,3,4,5,12	1, 2, 3
CO6	Analyze retrieved data with appropriate Python visualization libraries.	1,2,3,4,5,12	1, 2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3			√			
CO4		√				
CO5		√				
CO6				√		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2							3	3	3	3
CO2	3	3	3	3	2							3	3	3	3
CO3	3	3	3	3	2							3	3	3	3
CO4	3	2	2	3	2							3	3	3	3
CO5	3	3	3	3	2							3	3	3	3
CO6	3	3	3	3	3							3	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Fundamentals of Python Programming: Introduction to Python Features, Constants, Variables, Naming conventions, simple data types, indentation, operators and expressions, conditional statements, loops, functions, user defined functions, Working with Data Structures- Lists, tuples, sets and dictionaries.

Strings and File handling: Strings - definition, about Unicode, chr( ) and ord() function, creating strings, reading strings, slicing, concatenation and comparison of strings, string library functions. File Handling - definition, file access modes, reading text files and binary files, writing text files and binary files, file object attributes, file handling functions.

Exception Handling and Object-Oriented Programming concepts: Exception Handling - Definition of error and exception, difference between syntax error and exceptions, Try and Except Statement – Catching Exceptions, Catching Specific Exception, Try with Else Clause, finally keyword, Raising exception, NameError, TypeError, ZerDivisionError. Object Oriented Programming concepts- Definition of a class and object, class and object creation, self-parameter, constructors, modifying object properties, deleting object properties, OOP features - Encapsulation, Data abstraction, Inheritance, and polymorphism.

Python Libraries: NumPy - Basics of numpy, ndarray, dimensions in arrays, ndim attribute, ndmin attribute, accessing array elements, negative indexing, array slicing, array copy vs view, array shape, array reshaping, arange() function, matrix operations, universal array functions. Pandas - Basics of pandas, why use pandas, what can pandas do, Creation of DataFrame and Series, named indices, loc and iloc attribute, Load files into DataFrame. Matplotlib - Basics of matplotlib, features and advantages of matplotlib, Graphs/Plots.

Self-Learning Component:

Python SQL Database Access, seaborn, keras.

TEXT BOOKS:

1. Eric Mathes, "Python Crash Course, A Hands-on Project-Based Introduction to Programming", 2nd Edition, 2019.
2. Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly, 2nd Edition, 2020.
3. Michael Dawson, "Python Programming for the absolute Beginner", Cengage, 3rd Edition, 2020.

REFERENCE BOOKS:

1. Charles Dierbach, "introduction to Computer Science using Python", Wiley India Edition, 2015.
2. Allen B. Downey, "Think Python, How to think like a Computer Scientist", O'Reilly, 2nd Edition, 2017.
3. Mark Lutz, “Learning Python”, Oreilly. 2003.
4. Mark Pilgrim, “Dive into Python 3”, Apress special edition, second edition, 20l5.
5. T.R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
6. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning,, 1st Ed., 2012.
7. Michael Dawson, “Python Programming for the Absolute Beginners”, 3rd Edition, CENAGE Learning.
8. Paul Barry, Head First Python,by O'Reilly Media, Inc 2nd Edition Released November 2016.
9. Wesley J. Chun, “Core Python Programming”, 2nd Edition, Prentice Hall.

JOURNALS/MAGAZINES:

1. IEEE Transactions on Artificial Intelligence
2. Journal of Machine Learning Research
3. Foundations and Trends in Machine Learning
4. Synthesis Lectures on Artificial Intelligence and Machine Learning
5. ACM Transactions on Intelligent Systems and Technology

SWAYAM NPTEL/MOOCs:

1. Python for Data Science, Prof. Ragunathan Rengasamy, IIT Madras.
2. The Joy of Computing using Python, Prof. Sudarshan Iyengar, IIT Ropar.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to FPGA Design</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS414</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="3">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This subject deals studying the basics of a reprogrammable device i.e a field programmable gate array. This device can be programmed using VHDL, Verilog and other languages. In this course we introduce them to basic of FPGA.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Learn the basics of reprogrammable device like a FPGA.
2. Study the details of implementation of combitional logic with a FPGA.
3. Understand the implementation details of sequentail logic with a FPGA.
4. Introduce about the internals of a FPGA

COURSE OUTCOMES(COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study the fundamentals of programming a FPGA using HDL's	1,2 ,9,12	1,2
CO2	Design code using HDLs to design combinatorial circuits with a FPGA	1,2,3,4 ,9,12	1,2
CO3	Write HDL code to program sequential code using a FPGA.	1,2,3,4 ,9,12	1,2
CO4	Understand the internals of a FPGA to work for designing a system.	1,2,3,4, 5,9,12	1,2,3
CO5	Experiment hardware code with different FPGA's	1,2,3,4,5,9,12	1,2
CO6	Illustrate different experiment using HDL code with Intel Quartus	1,2,3,4, 5,9,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3			√			
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	√	√							√			√	√	√	
CO2	√	√	√	√					√			√	√	√	
CO3	√	√	√	√					√			√	√	√	
CO4	√	√	√	√	√				√			√	√	√	√
CO5	√	√	√	√	√				√			√	√	√	
CO6	√	√	√	√	√				√			√	√	√	√

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

FPGA based system

Introduction, basic concepts, digital design and FPGAs, FPGA based system design

FPGA Fabrics

Introduction, FPGA architectures, SRAM based FPGA, permanently programmed FPGA, chip IO, architecture of fabric

Combinational logic

Introduction, logic deisgn process, HDL, delay, optimization, arithmetic logic, logical implementation for fpga, physical design for fpga

Sequential logic

Introduction, sequential design process, design styles, rules for clocking, performance analysis, power optimization

Architectures

Introduction, behavioral design, design methodologies, examples.

Text Book:

1. FPGA based system design by wolf, ist edition, pearson edition

SWAYAM NPTEL/MOOCs:

1. https://nptel.ac.in/courses/117108040

<table>
<tr><td>Course Title</td><td colspan="4">Design and Analysis of Algorithms Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0405</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Workload</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

This course gives insight to the students about different algorithm design techniques. Understanding the fundamental concepts of writing algorithms for the given problem using appropriate algorithmic design technique and analyzing for its time complexity makes students to develop problem solving skill sets and coding methodology. This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. Deals with analyzing Time and Space complexity of algorithms and to evaluate trade-offs between different algorithms.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Demonstrate performance of algorithms with respect to time and space complexity.
2. Explain Graph and Tree traversals techniques.
3. Understand the concepts of greedy method and dynamic programming for different applications.
4. Illustrate the methods of Backtracking, Branch and bound techniques.
5. Familiarize the concepts of deterministic and non-deterministic algorithms.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Implement sorting and searching techniques using different algorithmic techniques.	1, 2, 3, 5, 9,12	1,2,3
CO2	Implement Tree Traversal method and Greedy Algorithms	1, 2, 3, 5, 9,12	1,2,3
CO3	Develop the skill set to solve problems using Dynamic Programming concepts.	1, 2, 3, 5, 6, 9,12	1,2,3
CO4	Illustrate Backtracking, Branch and Bound concept to solve various problems	1, 2, 3, 5, 6, 9,12	1,2,3
CO5	Demonstrate Time and Space complexities of various algorithms	1, 2, 3, 5, 6, 9,12	1,2,3
CO6	Analyze and evaluate different performance analysis methods for non-deterministic algorithms	1, 2, 3,4, 5, 6,9, 12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√				
CO2			√	√		
CO3			√	√		
C04				√		
CO5			√		√	
CO6			√	√	√	

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3		1				2			2	3	3	3
CO2	3	3	3		2				2			2	3	3	3
CO3	3	2	3		3	2			2			2	3	3	3
CO4	3	2	3		3	2			2			2	3	3	3
CO5	3	2	3		3	2			2			2	3	3	3
CO6	3	2	3		3	2			2			2	3	3	3

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Sort a given set of elements using the Quicksort method 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. The elements can be read from a file or can be generated using the random number generator.	Text Editor/ C IDE, C Compiler	C programming
2	a. Obtain the Topological ordering of vertices in a given digraph. b. Compute the transitive closure of a given directed graph using Warshall's algorithm.	Text Editor/ C IDE, C Compiler	C programming
3	Implement 0/1 Knapsack problem using Dynamic Programming.	Text Editor/ C IDE, C Compiler	C programming
4	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.	Text Editor/ C IDE, C Compiler	C programming

5	Find the Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.	Text Editor/ C IDE, C Compiler	C programming
6	Find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.	Text Editor/ C IDE, C Compiler	C programming
7	Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.	Text Editor/ C IDE, C Compiler	C programming
8	For a given graph a. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Check whether a given graph is connected or not using DFS method.	Text Editor/ C IDE, C Compiler	C programming
9	Implement N Queen's problem using Back Tracking.	Text Editor/ C IDE, C Compiler	C programming
10	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.	Text Editor/ C IDE, C Compiler	C programming

Project

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	Implement and analyze the performance of algorithms like Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, and Quick Sort. The project should generate the random datasets of varying sizes, apply each sorting algorithm to these datasets, and measure the time complexity. Students should present their findings, highlighting the strengths and weaknesses of each algorithm.	Text Editor/ C IDE, C Compiler	C programming
2	Students will choose problems that exhibit overlapping subproblems and optimal substructure. Examples include the 0/1 Knapsack problem, Longest Common Subsequence, and Matrix Chain Multiplication. The project involves implementing Dynamic Programming solutions, analyzing time and space complexities, and presenting the optimized solutions.	Text Editor/ C IDE, C Compiler	C programming
3	In this mini-project, students will explore various pathfinding algorithms applied to graphs or grids. Problems may involve finding the shortest path between two points, maze solving, or routing in a network. Common algorithms to be considered are Dijkstra's Algorithm, A* Algorithm, and Depth-First Search. Students will implement these algorithms, analyze their performance, and present their findings.	Text Editor/ C IDE, C Compiler	C programming
4	Implement various graph traversal techniques. Students will choose problems that require Breadth-First Search (BFS), Depth-First Search (DFS), or both. Examples include connectivity analysis, cycle detection, and node reachability. The project should involve implementing traversal	Text Editor/ C IDE, C Compiler	C programming

	algorithms, analyzing their applications, and presenting findings.		

TEXT BOOKS:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd edition, Pearson Education, 2017.
2. Ellis Horowitz, Satraj Sahni and Rajasekaran,Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd edition, PHI Learning Private Limited, 2017.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson.
3. Donald E. Knuth, “The Art of Computer Programming”, Volumes 1and 3 Pearson.

JOURNALS/MAGAZINES:

1. ACM Transactions on Algorithms.
2. ACM Journal of Algorithms and Computational Technology.

<table>
<tr><td>Course Title</td><td colspan="4">Microcontrollers and IoT Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0406</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Workload</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

Prerequisites:

1. Basic knowledge of programming concepts
2. Understanding of basic electronics and circuits

COURSE DESCRIPTION:

This lab course aims to provide hands-on experience in designing, programming, and implementing projects using microcontrollers and IoT technologies. Students will learn the fundamental concepts of microcontrollers, interfacing sensors and actuators, and building IoT systems. The lab exercises will involve hardware setup, programming, and real-world applications of microcontroller-based projects.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the architecture and working principles of microcontrollers
2. Develop programming skills for microcontrollers
3. Learn sensor interfacing techniques
4. Acquire knowledge of IoT protocols and communication methods
5. Design and implement IoT projects using microcontrollers
6. Troubleshoot and debug microcontroller-based systems

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify different communication protocols used in IoT applications and their characteristics.	1,2,3,4,5,6,9,11,12	1,2,3
CO2	Demonstrate an understanding of sensor interfacing principles and their application in data collection.	1,2,3,4,5,6,9,11,12	1,2,3
CO3	Apply programming skills to write code for microcontrollers to control sensors and actuators.	1,2,3,4,5,6,9,11,12	1,2,3
C04	Analyze and troubleshoot issues in microcontroller-based systems by identifying and resolving hardware or software problems.	1,2,3,4,5,6,9,11,12	1,2,3
CO5	Design and develop IoT projects by integrating microcontrollers, sensors, actuators, and cloud platforms.	1,2,3,4,5,6,9,11,12	1,2,3
CO6	Assess the security considerations and potential vulnerabilities in IoT systems implemented with microcontrollers.	1,2,3,4,5,6,9,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1	●					
CO2		●				
CO3			●			
C04				●		
CO5			●			
CO6				●		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3			3		3	3	3	2	2
CO2	3	3	3	3	3	3			3		3	3	3	2	2
CO3	3	2	1	3	2	2			3		2	3	3	2	2
CO4	2	2	2	2	2	2			2		2	2	3	2	2
CO5	2	2	2	2	2	2			2		2	2	3	2	2
CO6	3	2	3	2	2	2			2		2	2	3	2	2

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	LED Blinking: Write a program to control an LED connected to a microcontroller's GPIO pin. The LED should blink at a specific frequency.	Raspberry Pi	c/c++/python
2	Button Input: Write a program to read the state of a push button connected to a microcontroller's GPIO pin. Toggle the state of an LED based on the button press.	Raspberry Pi	c/c++/python
3	Temperature and Humidity Sensing: Interface a temperature and humidity sensor with the microcontroller. Write a program to read the sensor values and display them on an LCD or send them to a computer via serial communication.	Raspberry Pi	c/c++/python

4	Motion Detection: Interface a motion sensor with the microcontroller. Write a program to detect motion and trigger an action, such as turning on an alarm or activating a motor.	Raspberry Pi	c/c++/python
5	Data Logging: Implement a program to log sensor data to an external storage device (e.g., SD card). Store the data in a specific format for later analysis and visualization.	Arduino IDE/ PlatformIO / Raspberry Pi / Proteus	c/c++/python
6	Internet of Things (IoT) Data Transmission: Interface a microcontroller with an IoT platform (e.g., MQTT or cloud service). Write a program to collect sensor data and transmit it to the IoT platform for storage and analysis.	Arduino IDE/ PlatformIO / Raspberry Pi / Proteus	c/c++/python
7	Water Level Monitoring: Interface a water level sensor with the microcontroller and display the current water level on an LCD or send notifications when the water level reaches a certain threshold.	Arduino IDE/ PlatformIO / Raspberry Pi / Proteus	c/c++/python
8	Home Automation: Design a home automation system using the microcontroller and various sensors and actuators. Write programs based on user-defined rules and triggers to control lighting, temperature, and security systems.	Arduino IDE/ PlatformIO / Raspberry Pi / Proteus	c/c++/python
Project			
1	Smart Garden Irrigation Step 1: Set up the Hardware 1. Connect the soil moisture sensor to the Raspberry Pi's analog input pin (e.g., GPIO 0 or A0). 2. Connect the water pump to a GPIO pin (e.g., GPIO 17) on the Raspberry Pi. 3. Connect a relay module between the Raspberry Pi's GPIO pin and the water pump to control the pump's power. Step 2: Install Necessary Libraries Ensure you have the RPi.GPIO library installed, as it will be used to control the GPIO pins Step 3: Write the Python Code Create a Python script (e.g., smart_garden_irrigation.py) and add the code Step 4: Run the Python Script Open a terminal on your Raspberry Pi, navigate to the directory containing the smart_garden_irrigation.py script	Arduino IDE/ Raspberry Pi /	Python programming language

	The program will continuously monitor the soil moisture level. If the moisture goes below the specified threshold, the water pump will be turned on to water the plants for a short duration.		

2.	Weather monitoring station
	Step 1: Gather the Hardware
	Here's a list of the hardware components you'll need for the weather station:
	1. Raspberry Pi (any model with GPIO pins, but Raspberry Pi 3 or newer is recommended)
	2. DHT11 or DHT22 Temperature and Humidity Sensor
	3. BMP180 or BMP280 Barometric Pressure Sensor
	4. Breadboard and jumper wires
	5. MicroSD card (8GB or more) with Raspbian (or Raspberry Pi OS) installed
	6. Power supply for the Raspberry Pi
	7. Internet connection (Wi-Fi or Ethernet)
	Step 2: Set Up the Raspberry Pi
	1. Insert the microSD card with Raspbian into the Raspberry Pi.
	2. Connect the Raspberry Pi to a monitor, keyboard, and mouse for initial setup.
	3. Boot up the Raspberry Pi, follow the setup wizard to connect to Wi-Fi, and update the system using the terminal (sudo apt update && sudo apt upgrade).
	Step 3: Wiring the Sensors
	1. Connect the DHT11 or DHT22 sensor to the Raspberry Pi's GPIO pins for temperature and humidity readings.
	2. Connect the BMP180 or BMP280 sensor to the Raspberry Pi's GPIO pins for barometric pressure readings.
	3. Double-check the wiring and connections to ensure everything is properly connected.
	Step 4: Install Required Libraries
	1. Open the terminal on the Raspberry Pi.
	2. Install the necessary libraries for the sensors:
	For DHT11/DHT22 sensor:
	`pip install adafruit-circuitpython-dht`
	For BMP180/BMP280 sensor:
	`pip install adafruit-circuitpython-bmp180`
	or
	`pip install adafruit-circuitpython-bmp280`
		Arduino IDE/ Raspberry Pi /	Python programming language

	Step 5: Write the Python Code Create a Python script to read data from the sensors and display it Step 6: Run the Python Script 1. Save the Python script (e.g., weather_station.py) on the Raspberry Pi. 2. Open a terminal, navigate to the script's location, and run the script using: The data should now be displayed in the terminal as it is read from the se Step 7: Display Data on a Web Server To display the data on a web server, you can create a simple web application using Flask. Make sure Flask is installed on the Raspberry Pi:nsors. Next, modify the Python script to expose the sensor data through a web interface: Create a new folder in the same directory as the Python script called "templates." Inside this folder, create a new file called "index.html" with the following content:		

```
<!DOCTYPE html>
<html>
<head>
   <title>Weather Station</title>
</head>
<body>
   <h1>Weather Station</h1>
   <p>Temperature: {{ temperature }} °C</p>
   <p>Humidity: {{ humidity }}%</p>
   <p>Pressure: {{ pressure }} Pa</p>
   <p>Altitude: {{ altitude }} meters</p>
</body>
</html>
```

	Step 8: Access the Web Interface 1. Run the modified Python script again on the Raspberry Pi: 2. Open a web browser on any device connected to the same network as the Raspberry Pi. 3. Enter the Raspberry Pi's IP address in the browser's address bar, and you should see the weather data displayed on the web page.		
3.	Intrusion Detection System Step 1: Gather the Hardware Here's a list of the hardware components you'll need for the intrusion detection system:	Arduino IDE/ Raspberry Pi /	Python programming language

1. Raspberry Pi (any model with GPIO pins, but Raspberry Pi 3 or newer is recommended)
2. Raspberry Pi Camera Module (or USB webcam)
3. Breadboard and jumper wires (if using a PIR motion sensor)
4. Passive Infrared (PIR) Motion Sensor (optional)
5. MicroSD card (8GB or more) with Raspbian (or Raspberry Pi OS) installed
6. Power supply for the Raspberry Pi
7. Internet connection (Wi-Fi or Ethernet)

Step 2: Set Up the Raspberry Pi

1. Insert the microSD card with Raspbian into the Raspberry Pi.
2. Connect the Raspberry Pi to a monitor, keyboard, and mouse for initial setup.
3. Boot up the Raspberry Pi, follow the setup wizard to connect to Wi-Fi, and update the system using the terminal (sudo apt update && sudo apt upgrade).

Step 3: Install Required Libraries

1. Open the terminal on the Raspberry Pi.
2. Install the necessary libraries for the camera module and email notifications:

Step 4: Connect the Camera Module

If you are using the official Raspberry Pi Camera Module, attach it to the CSI port on the Raspberry Pi. Make sure it's properly connected.

Step 5: Write the Python Code

Create a Python script to detect motion using the camera module and send notifications via email.

Step 6: Run the Python Script

1. Save the Python script (e.g., intrusion_detection.py) on the Raspberry Pi.
2. Open a terminal, navigate to the script's location, and run the script using:

Step 7: Test the Intrusion Detection

Move in front of the camera to trigger the motion detection. When motion is detected, an image will be captured and sent to the specified email address.

Note: Email notifications require access to an SMTP server and valid email credentials for sending emails. If you don't have access to an SMTP server, you can also use third-party email services or APIs that provide email functionality.

4.	IoT-based vehicle tracking system Step 1: Gather the Hardware Here's a list of the hardware components you'll need for the vehicle tracking system: 1. Arduino board (Arduino Uno, Arduino Nano, or similar) 2. GPS module (such as NEO-6M or NEO-M8N) 3. GSM module (SIM800L or similar) for sending GPS data to a server 4. Breadboard and jumper wires 5. Antenna for the GPS and GSM modules 6. SIM card with a data plan (for the GSM module) 7. Power supply (battery or DC adapter) for the Arduino and modules Step 2: Connect the Hardware 1. Connect the GPS module to the Arduino board using jumper wires. Typically, the GPS module communicates with Arduino through UART (Serial Communication). 2. Connect the GSM module to the Arduino board using jumper wires. Ensure you connect the required TX and RX pins between the GSM module and Arduino for communication. 3. Connect the antennas to the GPS and GSM modules. Step 3: Set Up Arduino IDE 1. Download and install the Arduino IDE from the official Arduino website. 2. Connect your Arduino board to your computer using a USB cable. 3. Open the Arduino IDE and set the correct board and port under the "Tools" menu. Step 4: Install Required Libraries 1. In the Arduino IDE, go to "Sketch" > "Include Library" > "Manage Libraries." 2. Search and install the necessary libraries for GPS and GSM modules. For GPS, you may need a library like TinyGPS++ or Adafruit GPS library. For GSM, you may need a library like Adafruit FONA. Step 5: Write the Arduino Code Now, you'll write the Arduino code to read GPS data and send it to a server via the GSM module. Step 6: Upload the Code to Arduino	Arduino IDE/ Raspberry Pi /	programming language

	Verify and upload the Arduino code to your Arduino board using the Arduino IDE. Step 7: Set Up the Server You need a server to receive and store the GPS data sent by Arduino. You can use a cloud-based server, a web hosting service, or set up your own server. The server should have an endpoint to handle HTTP requests and store the received GPS data in a database. Step 8: Test the Vehicle Tracking System Power up the Arduino with the GPS and GSM modules and place it in the vehicle. The Arduino will read GPS data and send it to the server via the GSM module. You can then check the server to see the received GPS data and track the vehicle's location in real time.		

TEXT BOOKS:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay. The 8051 Microcontroller and Embedded Systems Using Assembly and C. Pearson/Prentice Hall, 2006
2. Richard Blum. Arduino Programming in 24 Hours, Sams Teach Yourself. Pearson Education, Inc. 2015
3. Perry Lea."Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security". Packt Publishing Ltd, 2018

<table>
<tr><td>Course Title</td><td colspan="4">Database Management Systems Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0403</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Workload</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>0</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE DESCRIPTION:

This course is designed to provide the practical knowledge and skills required to build successful database applications and their management using a commercial relational DBMS of MySQL. It provides an understanding of the fundamental concepts behind the development of database systems including experiments on database design using Entity-Relationship Diagram. It imparts the importance of enforcing integrity constraints that are necessary to design sound databases. The experiments designed for this course aim to provide the understanding of formulating queries required for data definition, data manipulation, transaction control and view definition. It further includes advanced operations of joins, aggregate functions, nested queries, conditional statements and correlated nested queries. This course will help students to demonstrate strong database management skills to keep up with the database industry.

COURSE OBJECTIVE (S):

The objectives of this course it to:

1. To engage themselves in lifelong learning of Database management systems, Theories and technologies this enables them to purse higher studies.
2. To interact professionally with colleagues or clients located abroad and the ability to overcomechallenges that arises from geographic distance, cultural differences, and multiple languages inthe context of computing.
3. Develop team spirit, effective work habits, and professional attitude in written and oral forms,towards the development of database applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic concepts of Database Systems and Applications.	1 to 5,9,10,12	1,3
CO2	Use the basics of MySQL and construct queries using MySQL indatabase creation and interaction.	1 to 5, 9,10,12	1,3
CO3	Design a commercial relational database system (Oracle, MySQL) by writing MySQL using the system.	1 to 5,9,10,12	2,3
C04	Analyze and Select storage and recovery techniques of databasesystem.	1 to 5,9,10,12	1,2
CO5	Construct the physical and logical database designs, databasemodeling, relational, hierarchical, and network models.	1 to 5, 9,10,12	1,2
CO6	Relate conceptual model to relational model and formulate relational algebra queries.	1 to 5, 9,10,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			√			
CO2			√			
CO3			√			
C04			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				2	3		2	3	3	
CO2	3	3	2	3	1				2	3		2	3	3	
CO3	3	3	2	3	3				2	3		2	3	3	3
CO4	3	3	2	3	1				2	3		2	3	3	
CO5	3	2	3	3	3				3	3		3	3		3
CO6	3	3	2	3	3				3	3		3		3	3

Practice:

PART- A - EXPERIMENTS			
No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Implementation of DDL, DML, DCL and TCL commands of SQL with suitable examples.	Oracle MySQL	• Ability to write SQL statements to create and modify database objects based on defined requirements.

2	Study & Implementation of different types of constraints with suitable examples.	Oracle MySQL	• Ability to designate primary keys during table creation (CREATE TABLE) or alteration (ALTER TABLE). • Understanding how to choose appropriate columns as primary keys
3	Implementation of different types of function, operators, Joins with suitable examples.	Oracle MySQL	• Proficiency in using built-in scalar functions provided by the database management system (DBMS).
4	Study and Implementation of • Group By & having clause • Order by clause • Indexing • Views Sub queries	Oracle MySQL	• SQL Syntax: Proficiency in using GROUP BY in conjunction with aggregate functions to summarize data.
5	Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc. using Conceptual Designing (Ex:- ER Diagrams).	Oracle MySQL	• Domain Understanding: Ability to understand the business domain and identify relevant entities.

6.	Consider the following schema for a Library Database: 1. BOOK (Book_id, Title, Publisher_Name, Pub_Year) 2. BOOK_AUTHORS (Book_id, Author_Name) 3. PUBLISHER (Name, Address, Phone) 4. BOOK_COPIES (Book_id, Branch_id, No-of_Copies) 5. BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) 6. LIBRARY_BRANCH (Branch_id, Branch_Name, Address) 7. CARD(CARD_NO INTEGER PRIMARY KEY); Write SQL queries to: 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.	Oracle MySQL	- Skills Needed: Ability to define and categorize book attributes based on library cataloging standards (e.g., MARC format), understanding of book metadata.

7	Consider the schema for College Database and draw and ER Diagram. STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) SUBJECT (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C' Section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the	Oracle MySQL	• Skills Needed: Ability to define student attributes, manage enrollment and academic progress data, understanding of student privacy regulations (e.g., FERPA in the US).

PART B- Mini- Project

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	**For any problem selected like Hospital Management System, Blood Bank Management System, Library Management System-** • Make sure that the application should have five or more tables • Indicative areas include; health care, Laboratory Outcomes: The student should be able to: ➢ Create, Update and query on the database. ➢ Demonstrate the working of different concepts of DBMS ➢ Implement, analyze and evaluate the project developed for an application with the front end compatibility.	Oracle MySQL	*Skills Needed:* • **Database Design**: • **User Interface Development**: • **Functionality Implementation** • **Testing and Debugging**:

TEXT BOOKS:

1. Elmasri and Navathe,“Fundamentals of Database Systems”, Pearson Education, 5th Edition, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, McGraw-Hill, 3rd Edition, 2003.

REFERENCE BOOKS:

1. Rick Silva, “MySQL Crash Course: A Hands-on Introduction to Database Development”, 2023.
2. Paul DuBois, “MySQL Cookbook: Solutions for Database Developers and Administrators” 3rd Edition, 2014

JOURNALS/MAGAZINES:

1. http://www.ijstr.org/final-print/june2019/Database-Management-System.pdf
2. https://www.dbjournal.ro/

<table>
<tr><td>Course Title</td><td colspan="4">Course based Project</td><td colspan="2">Course Type</td><td colspan="2">SDC</td></tr>
<tr><td>Course Code</td><td>B24EI0404</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

Course Overview:

This course emphasizes hands-on learning through a series of projects. Students will apply theoretical knowledge to practical tasks, developing skills in problem-solving, critical thinking, collaboration, and communication. The projects will cover various topics within the subject and will require students to use tools and techniques relevant to the field.

Course Objectives:

The objective of this course is to:

1. Apply theoretical concepts to practical scenarios.
2. Develop project management and organizational skills.
3. Enhance problem-solving and critical thinking abilities.
4. Collaborate effectively with peers.
5. Communicate findings and results clearly.

COURSE OUTCOMES (CO'S):

After successful completion of this course, the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3

CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
CO#	**Remember (L1)**	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low, 2-Medium, 3-High

Project Description:

The objective of this project is to design, implement, and analyse a range of algorithms to solve specific computational problems. The project aims to develop a deep understanding of algorithmic design principles, efficiency analysis, and practical applications.

List of Sample Projects:

1. E-commerce Product Recommendation System

Problem Statement:

Develop a product recommendation system for an e-commerce platform to suggest relevant products to users based on their browsing and purchasing history.

Implementation Description:

- **User-Item Matrix:** Represent user preferences with a matrix where rows represent users and columns represent items.
- **Data Structures:**
    - **Matrix:** Store user ratings and interactions with products.
    - **Hash Map:** Map user IDs and product IDs to their respective indices in the matrix.
- **Algorithm:** Implement collaborative filtering techniques (user-based or item-based) and matrix factorization algorithms like Singular Value Decomposition (SVD) to generate recommendations.

2. Dynamic Memory Allocation

Problem Statement:

Implement a dynamic memory allocator that efficiently handles memory allocation and deallocation requests.

Implementation Description:

- **Memory Representation:** Manage a large contiguous block of memory.
- **Data Structures:**
    - **Linked List:** Use a free list to manage free memory blocks.
    - **Heap:** Implement a heap to manage allocated memory.
- **Algorithm:** Implement algorithms for first-fit, best-fit, and worst-fit memory allocation strategies. Optimize deallocation to minimize fragmentation.

3. Real-Time Chat Application

Problem Statement:

Develop a real-time chat application that supports multiple users and ensures efficient message delivery and storage.

Implementation Description:

- **Message Representation:** Represent messages with unique IDs, timestamps, and user IDs.
- **Data Structures:**
    - **Queue:** Handle incoming and outgoing messages.
    - **Hash Map:** Store user sessions and message histories.
- **Algorithm:** Implement efficient message routing algorithms and data structures to handle high concurrency and ensure real-time communication.

4. Resource Allocation in Cloud Computing

Problem Statement:

Create a system for efficient resource allocation and management in a cloud computing environment.

Implementation Description:

- **Resource Representation:** Model resources (CPU, memory, storage) as entities with capacities.
- **Data Structures:**
    - **Priority Queue:** Manage resource allocation requests based on priority.
    - **Hash Map:** Store resource usage statistics.
- **Algorithm:** Implement resource allocation algorithms (First-Come, First-Served, Round Robin, Priority Scheduling) to optimize resource utilization and ensure fairness.

<table>
<tr><td>Course Title</td><td colspan="4">Professional Ethics</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td></td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>1</td><td>1</td><td>1</td><td>14</td><td></td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

The course enables e the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Understand the professional Rules of conduct for Engineers.
2. Appreciate codes of conduct, professional Rules of conduct.
3. Recognize the conflict of interest and Develop strategies
4. Understand the importance of communication with all stakeholders.
5. Apply practical strategies for handling ethical dilemmas.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Understanding basic purpose of profession, professional ethics and various moral and social issues.	8,9,10	
CO2	Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer	8,9,10	
CO3	Acquiring knowledge of various roles of Engineer In applying ethical principles at various professional levels	8,9,10	
CO4	Professional Ethical values and contemporary issues	8,9,10	
CO5	Apply practical strategies for handling ethical dilemmas	8,9,10	
CO6	Appreciate codes of conduct, professional Rules of conduct	8,9,10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			
CO6	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2	2					
CO2								3	2	2					
CO3								3	2	2					
CO4								3	2	2					
CO5								3	2	2					
CO6								3	2	2					

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, OxfordUniversityPress,2015.
2. Ethics in Engineering Practice &Research, CarolineWhitbeck,2e, Cambridge University Press 2015.

REFERENCE BOOKS:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr.,Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.

2. Business Ethics concepts & Cases: ManuelGVelasquez,6e,PHI, 2008.

Evaluation pattern:

1. Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment
2. Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.
3. Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

<table>
<tr><td>Course Title</td><td colspan="3">Universal Human Values</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22EE0310</td><td>Credits</td><td colspan="2">1</td><td>Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>1</td><td>1</td><td>1</td><td>14</td><td>0</td><td>25</td><td>25</td></tr>
</table>

COURSE OBJECTIVE:

The objective of this course is to

1. Development of a holistic perspective based on self- exploration about themselves (human being), family,society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applyingthem in their life and profession.	6,7,8	1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	6,7,8	1
CO3	Understand the role of a human being in ensuring harmony in society and nature.	6,7,8	1
CO4	Demonstrate the role of human being in the abetment of pollution.	6,7,8	1
CO5	Describe appropriate technologies for the safety and security of the society as responsible human being.	6,7,8	1
CO6	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.	6,7,8	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyse (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		**√**	**√**			
CO2		**√**	**√**			
CO3		**√**	**√**			

CO4		√	√			
CO5		√	√			
CO6		√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	2	1					1	
CO2						3	2	1					1	
CO3						3	2	1					1	
CO4						3	2	1					1	
CO5						3	2	1					1	
CO6						3	2	1					1	

Note: 1-Low, 2-medium, 3-High

COURSE CONTENT

Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs ofSelf ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co- existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management modelsand production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010
4. Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

Reference Books:

1.Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997

2.I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970

3.Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993

Evaluation pattern:

· Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment

· Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.

· Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	**Environmental Science**				**Course Type**		**MC**	
Course Code		**Credits**	**-**		**Class**		**IV Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**1**	**1**	**1**	**14**	**-**	-	-

Course Overview: Environmental Science is focussed on a holistic understanding of earth systems in order to learn from the past, comprehend the present and influence the future. It is the study of how physical, chemical and biological processes maintain and interact with life, and includes the study of how humans affect nature. As environmental science is at the cross-roads of the natural sciences, it provides an enriching alternative to a single-subject honours degree, and can open the door to an exciting range of career options. This approach enables us to tackle necessary problems, such as ensuring that human needs are met in a sustainable way, so that everyone has access to clean water and air, and the resources required for agriculture and industrial activity.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiar with current and emerging environmental engineering and global issues and have an understanding of ethical and societal responsibilities.
2. Recognize the need for engaging in life-long learning.
3. Study various types of energy (conventional & non-conventional) resources and natural resources.
4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.
5. Know about sources, effects and control measures of environmental pollution, degradation, and waste management.
6. Explore the ways for protecting the environment.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	7,9,10	**1**
CO2	List the causes, effects & remedial measures of environmental pollution, degradation & find ways to overcome them by suggesting the pollution controlled products.	7,9,10	**1**
CO3	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	7,9,10	**1**
CO4	Critically analyse the ecological imbalances and provide recommendations to protect the environment.	7,9,10	**1**
CO5	Explore the condition of environmental degradation and waste management techniques and take promising measures to make our environment eco-friendly.	7,9,10	**1**

CO6	Identify new methodologies for conservation of our natural resources and ecosystem.	7,9,10	**1**

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓	✓				
CO3	✓					
CO4	✓					
CO5	✓	✓				
CO6	✓					

COURSE ARTICULATION MATRIX:

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1							2		2	2			1		
CO2							2		2	2			1		
CO3							3		2	2			1		
CO4							3		2	2			1		
CO5							2		2	2			1		
CO6							3		2	2			1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:
THEORY:

Environment and Environmental Protection

Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

Environmental protection: Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations.

Environmental pollution, degradation & Waste management:
Environmental Pollution: Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Automobile Pollution-Causes, Effects & control measures.
Environmental degradation: Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Waste management: Municipal solid waste, Bio-medical waste and Electronic waste (E-Waste).

Energy & Natural resources:

Energy: Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, Hydrogen as an alternative as a future source of energy.

Natural resources: Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance. Forest wealth - Importances, Deforestation-Causes, effects and controlling measures

Ecology, ecosystem & field work:
Ecology - Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Components of ecosystem-abiotic and biotic.
Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity.

Field work: Visit to waste water/sewage treatment plant (STP) and biogas plant at REVA university campus, and/or Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

TEXT BOOKS:

1. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.

2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2nd Edition, 2014.

3. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, 2nd Edition, 2008.
4. Dr.S.M.Prakash, "Environmental Studies", Elite Publishers, Mangalore, 2nd Edition, 2009.

5. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, 3rd Edition, 2016.

Examination Pattern:

The course is Mandatory course, As per the regulations 23-24 no IA tests or assignments for the course evaluation. Semester End Examination question paper is of MCQ pattern set for maximum marks of 50. Marks obtained is scaled down to 25.

Links for EVS Online resources

Link for online	**Title of the course**	**Course Duration**
https://www.classcentral.com/course/swayam-environmental-studies-14042	**Environmental Studies**	**12 Weeks** **Free Online**
https://www.edx.org/course/introduction-to-environmental-science-2?index=product&search_index=product&webview=false&campaign=Introduction+to+Environmental+Science&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science	**Introduction to Environmental Sciences**	**5hrs/Week** **For Weeks**
https://www.coursera.org/specializations/environmental-science?action=enroll	**Introduction to Environmental Science Specialization**	**5hrs/Week** **12 Weeks**

Course Title	AEC-2 (Ability Enhancement Course Placement Training)				Course Type		AEC	
Course Code	B24EF0409	Credits	1		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	1	2	2	-	28	25	25

COURSE OVERVIEW

Placement training classes can effectively be conducted as a part of an Ability Enhancement Course (AEC). These courses are designed to enhance students' skills, making them more prepared and competitive for the job market.

V SEMESTER

V Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EF0501	Computer Networks	HC	3	0	0	3	3	50	50	100	PCC
2	B24EI0501	IoT System Processors	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0502	Web Technology	HC	3	0	0	3	3	50	50	100	PCC
4	B24EIS51X	Professional Elective-3	SC	3	0	0	3	3	50	50	100	PEC
5	B24EIS52X	Professional Elective-4	SC	3	0	0	3	3	50	50	100	PEC
6	B24EFO51X	Open Elective-1	OE	3	0	0	3	3	50	50	100	OE
7	B24EF0504	Computer Networks Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0503	IoT System Processors Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0504	Web Technology Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EF0507	AEC-3 (Ability Enhancement Course - Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
11	B24-	Indian Knowledge System	MC	1	0	0	0	1	25	25	50	HSMC
TOTAL				**19**	**0**	**4**	**22**	**27**	**425**	**425**	**850**	
TOTAL SEMESTER CREDITS					**22**							
TOTAL CUMULATIVE CREDITS					**111**							
TOTAL CONTACT HOURS					**27**							
TOTAL MARKS					**850**							

<table>
<tr><td>Course Title</td><td colspan="4">Computer Networks</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0501</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

The main emphasis of this course is on the organization and management of local area networks (LANs). The course description includes learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and about Open Systems Interconnection (OSI) communication model with TCP/IP protocol; This course provides knowledge of error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login Protocols.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication.
2. Discuss the MAC protocols, error detection & correction strategies for data transmission over the networking devices.
3. Describe the standards for data communication with routing protocols.
4. Illustrate the client server communication using TCP or UDP protocols and other application level protocols.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1 to 6,9,10, 12	2
CO2	Discover the good network design with simplicity, scalability, performance and the end-to-end principle	1 to 6,9,10, 12	2
CO3	Appraise the working principles of Internet.	1 to 6,9,10, 12	3

CO4	Compile the effectiveness of existing or similar network protocols.	1 to 6,9,10, 12	2,3
CO5	Summerize the key components of the Network.	1 to 6,9,10, 12	2, 3
CO6	Demonstrate different protocols used in real world application.	1 to 6,9,10, 12	2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√	√		
CO3			√	√	√	
CO4			√	√	√	√
CO5		√				
CO6		√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1			3	3		1		3	
CO2	3	3	3	3	2	2			3	3		1		3	
CO3	3	3	3	3	2	1			3	3		2			3
CO4	3	3	3	2	2	1			3	3		1		3	3
CO5	3	3	3	3	2	2			3	3		2		3	3
CO6	3	3	3	3	2	2			3	3		2		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Content

Introduction to Data Communication and Networking: Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols & Standards. Layered Architectures: Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing. Introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, Physical Layer: Introduction to Transmission Media, Periodic Analog signals, Digital signals, Nyquist bit rate, shanon capacity, performance, PCM, Parallel transmission, serial transmission.

Coding: Line Coding, Error Detection and Correction: Introduction, cyclic Codes: CRC, Internet checksum. Framing, Data Link Protocols: Point-to-Point Protocol. MAC Protocols: classification of MAC protocols, Random access (ALOHA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token passing), Channelization Protocols (FDMA, TDMA, CDMA). Introduction to Networking Devices: Repeaters, Hubs, Bridges, Routers, and High layered switches, Gateways, Virtual LAN.

Network Layer: IPv4 addresses, IP Datagram format, ICMP Messages, Introduction to Mobile IP for mobility management, IPv6 addresses, IPv6 Packet Format, Transition from IPv4 to IPv6, Routing algorithms (Distance Vector, Link State and Path vector).

Transport Layer: Introduction to Stop and Wait, GoBack-N, Selective repeat N, Piggybacking. Services and port numbers, User Datagram Protocol (UDP): UDP Segment, Transmission Control. Protocol (TCP): TCP Segment, TCP Connection Set up, Application of TCP and UDP. TCP flow control, TCP error control, TCP Congestion Control. Application Layer: DNS, SMTP. Introduction to Remote Login Protocols: TELNET Protocol and SSH Protocol.

Self-Learning Component:

Wifi, WiMAX, 4G, 5G, Satellite Networks, MPLS, VPN, ATM, Bluetooth Architecture, World Wide Web (WWW).

TEXT BOOKS:

1. Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw – Hill, 2016.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education, 2009

REFERENCE BOOKS:

1. Alberto Leon-Garcia and Indra idjaja, "Communication Networks – Fundamental Concepts and Key Architectures", 2nd Edition Tata McGraw – Hill, 2004.

2. Andrew S. Tanenbaum, “Computer Networks”, 4th Edition, Pearson Education, 2005.
3. Larry L. Peterson and Bruce S. Davie, “Computer Networks- A system Approach”, 5th Edition, Elsevier, 2012.
4. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2008.
5. Douglas E. Comer, “Internetworking with TCP/IP Vol.1”, 6th Edition, Pearson, 1995.

JOURNALS/MAGAZINES

1. IEEE Transactions on Networking.
2. Elsevier Journal of Computer Networks
3. Springer Journal of communications and Information networks.

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/topic/computer-network/
2. https://www.coursera.org/courses?query=computer%20network
3. https://nptel.ac.in/courses/106/105/106105183/
4. https://www.edx.org/learn/computer-networking

<table>
<tr><td>Course Title</td><td colspan="4">IoT System Processors</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0501</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>0</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td></td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course provides a comprehensive framework for understanding IoT system processors for developing IoT applications with in-depth understanding of the processors used in IoT systems. It covers the architecture, debug tools, and integration of various processors and microcontrollers in IoT applications. Students will learn about basic system processors, their architecture, and how to choose the right processor for specific IoT applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

- Understand the basics of computer IoT system processor
- Make students capable of selecting the OS for designing IoT system
- Select and integrate components such as processors,
- Design a system software architecture by using various debugging tools that can be applied to IoT devices.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Recognize the IoT processor and its ecosystem.	1,2	1
CO2	Explain the mechanism of selecting the OS for designing the system	1,2	1
CO3	Understand choosing the CPU that fits w.r.t. core architecture, MMU, FPU and crypto engine.	1,2,3	2
CO4	Design the software architecture	1,2,3,4,	1
CO5	Understand use of various Debug Tools for Monitoring messages, test traffic.	1,2,3,6	3
CO6	Demonstrate the different software co-design techniques for microcontroller-based embedded systems, and apply techniques in IoT applications.	1.2.3.4.5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	•					
CO2		•				
CO3		•				
CO4			•			
CO5		•				
CO6			l			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3	3											3	
CO4	3	3	3	3									3		
CO5	3	3	2			2									3
CO6	3	3	3	3	2										3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction and basic system: Introduction, How to select an OS: strictly polling, Co-routines, Interrupts, A small Realtime Kernal, A non-preemptive Operating System, full OS, Open source , OS constructs.

Choosing the CPU: overview, CPU Core architecture, word size, MMU-memory management unit, RAM, Cache, EEPROM and Flash, FPU-Floating Point Unit, DSP, Crypto-Engine, Upgrade path, second sources, expert control, RoHS control, Tool chains and evaluation boards, Benchmarks and power consumption.

Software Architecture: Design for Performance, The fear of white papers, layers, More files, Containment Hierarchy, case: CANOpen, Message Passing, Middleware. Case: Architecture Reuse in LAN-XI, Understanding C.

Debug Tools: simulator, ICE, JTAG debugger, Target stand-in, Debugger, strace, Debugging without special tools, Monitoring messages, test traffic.

TEXTBOOKS:

1. Klaus Elk, "Embedded Software for the IoT".
2. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed
3. Elizabeth Gootman et. al, "Designing Connected Products", Shroff Publisher/O'Reilly Publisher.

REFERENCE BOOKS:

1. Pethuru Raj and Anupama C. Raman (CRC Press) , The Internet of Things : Enabling Technologies, Platforms and Use Cases.

2. ArshdeepBagha and Vijay Madisetti Internet of Things: A Hands-on Approach.

3. Research articles from Journals and Conference Proceedings.

JOURNALS/MAGAZINES:

https://link.springer.com/book/10.1007/978-3-030-85863-6

SWAYAMNPTEL/MOOCs:

https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Self-Learning Component:

Code Maintenance, IoT Technologies, Network tools.

Course Title	Web Technology				Course Type		HC	
Course Code	B24EI0502	Credits	3		Class		V Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW:

The Web Technology course typically covers fundamental concepts and technologies used in web development. Topics often include HTML, CSS, JavaScript, server-side scripting languages (like PHP, Python, or Node.js), databases (SQL and NoSQL), web frameworks (such as React, Angular, or Django), and web security principles. Students learn to design, build, and deploy dynamic web applications while understanding the underlying protocols and standards that govern the internet and web development.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the basics of web technology
2. Make students capable of selecting the HTML and CSS scripts
3. Apply Javascript functions to study DOM
4. Design a system with various HTML,CSS,PHP,DOM styles to a web page

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply semantic markup techniques to enhance the accessibility and create HTML tables and forms with appropriate structure and styling.	1,2	1
CO2	Evaluate the effectiveness of CSS styles in enhancing webpage layout with design and analyze the accessibility and responsiveness of CSS layouts across different devices.	1,2	1
CO3	Apply JavaScript functions to manipulate the Document Object Model (DOM) and develop interactive web forms with validation and event handling using JavaScript.	1,2,3	2
CO4	Analyze the performance and compatibility of JavaScript implementations across different web browsers.	1,2,3,4,	1
CO5	Understand the basic concepts of server-side development with PHP.	1,2,3,6	3
CO6	Analyze the efficiency and scalability of PHP scripts in accessing and managing MySQL databases.	1.2.3.4.5	3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2					✓	
CO3			✓			
CO4				✓		
CO5		✓				
CO6				✓		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	1	1	1	1	2	1	2	3	3	2
CO2	2	3	3	3	3	2	2	2	2	3	1	2	3	3	2
CO3	3	3	3	1	3	1	1	2	1	2	1	2	3	3	2
CO4		3	3	3	3	1	2	2	1	1	1	2	3	3	1
CO5	3	1	1	1	3	1	2	1	2	2	1	2	3	1	3
CO6	3	3	3	3	3	1	1	2	1	1	1	2	3	1	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Hypertext Markup Language

Introduction to HTML: HTML Syntax, Semantic Markup, Structure of HTML Documents, HTML Elements, HTML Semantic Structure Elements.

HTML Tables and Forms: Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Micro formats

Cascading Style Sheets (CSS)

CSS Overview: CSS Rules, CSS Syntax and Style, Selectors, span and div Elements - Cascading, External CSS Files - CSS Properties: Color Properties, Font Properties, line-height Property, Text Properties, Border Properties. Element Box, padding Property, margin Property.

CSS Layout: CSS Structural Pseudo-Class Selectors, thead and tbody Elements, Cell Spanning, Web Accessibility, CSS display Property with Table Values, Absolute Positioning with CSS Position Properties, Relative Positioning.

Client Side scripting

Introduction to JavaScript: Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, DOM, Forms: form Element, Controls, Text Control, Accessing a Form's Control Values, reset and focus Methods, Event Handler Attributes.

Advanced JavaScript: While Loop, External JavaScript Files, do Loop, Radio Buttons, Checkboxes, for Loop - fieldset and legend Elements, Manipulating CSS with JavaScript, Using z-index to Stack Elements, Textarea Controls, Pull-Down Menus, List Boxes.

React JS: React Environment Setup - ReactJS Basics - React JSX - React Components: React Component API - React Component Life Cycle - React Constructors - React Dev Tools - React Native vs ReactJS.

Server side scripting

Introduction to server-side Development with PHP, Arrays and Super global, Arrays, $GET and $POST Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design.

Working with Databases: SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.

Error Handling and Validation: PHP Error reporting, PHP error and exception handling, Regular expression, Validating user input, Where to perform Validation.

Self Learning Component: React Dataflow: React State - React Props - React Props Validation - Styling React - Hooks and Routing - Deploying React - Case Studies for building dynamic web applications.

TEXT BOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development”, Pearson Education India, 1st Edition, 2016
2. Dean, J., Web Programming with HTML5, CSS, and JavaScript. Jones & Bartlett Learning, 2018
3. Minnick, C. Beginning ReactJS foundations building user interfaces with ReactJS: An App

REFERENCE BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 1st Edition, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2007.
3. HTML & CSS: The Complete Reference Thomas A. Powell, , Fifth Edition, Tata McGraw Hill.
4. Harvey M Deitel, Paul J Deitel and Tem R Nieto, Internet and World Wide Web How to Program, Pearson, 6th Edition, 2020.
5. Rebah, H.B., Boukthir, H. and Chedebois, A., Website Design and Development with HTML5 and CSS3. John Wiley & Sons, 2022.
6. Robin Nixon, “Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5”, O’Reilly Publications, 4th Edition, 2015.
7. Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Pearson Education, 5th Edition 2016.
8. Nicholas C Zakas, “Professional JavaScript for Web Developers”, Wrox/Wiley India, 3rd Edition 2012.

JOURNALS/MAGAZINES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview
2. An Analysis of the Latest Features and Trends in HTML5 by Smith, A. et al. (Journal of Web Engineering, 2023)
3. Recent Advances in CSS3 Layout Techniques by Patel, S. (ACM Transactions on the Web, 2023)
4. Comparative Analysis of Popular JavaScript Frameworks for Modern Web Development" by Garcia, M. et al. (Journal of Software Engineering Research and Development, 2023)
5. State of JavaScript Frameworks: A Comprehensive Survey by Kim, H. et al. (ACM Computing Surveys, 2022)
6. ReactJS: Trends, Challenges, and Future Directions by Gupta, S. et al. (Journal of Web Development, 2023)
7. Optimizing ReactJS Performance: Best Practices and Techniques by Zhang, L. et al. (IEEE Software, 2022)
8. PHP 7: New Features and Performance Improvements by Rodriguez, J. et al. (Journal of Systems and Software, 2023)
9. Securing PHP 7 Applications: Current Challenges and Solutions by Martinez, E. et al. (Information and Software Technology, 2022)

SWAYAM NPTEL/MOOCs

1. "Web Design for Everybody (Basics of Web Development and Coding)" by Coursera (offered by University of Michigan)
2. "JavaScript for Web Developers" by Udemy (various instructors)
3. "React.js: Getting Started" by Pluralsight (offered by Samer Buna)
4. "PHP for Web Development" by Udacity (offered by Google)

Course Title	Theory of Computation				Course Type		SC	
Course Code	B24EIS511	Credits	3		Class		V Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

The course introduces some fundamental concepts in theory of computation including finite automaton, regular expression, formal language, grammar, pushdown automation, and Turing machine which form basic models of computation also the foundation of many branches of computer science.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Compare the concepts of Deterministic and Non-Deterministic Finite Automata.
2. Demonstrate the use of regular expressions for constructing DFA and NFA.
3. Illustrate the construction of context free grammar for a given language.
4. Explain computing Machine including PDA and Turing Machine.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the Finite State Machine by applying the concepts of DFA and NFA.	1 to 5, 12	1
CO2	Make use of regular expressions for constructing DFA and NFA.	1 to 5,12	2
CO3	Identify ambiguity in grammar and Construct CFG for the given language in Normal Forms.	1 to 5,12	3
CO4	Apply the concepts of Push down Automata and Turing machine for a given Language.	1 to 5,12	2
CO5	Outline the notions of computation, such as algorithm, computability, decidability, reducibility, and complexity, through problem solving.	1 to 5,12	1,2
CO6	Choose mathematical foundations, algorithmic principles and computer science theory to model and design of computer based systems.	1 to 5,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOME

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5		√				
CO6	√					

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1							1	3		
CO2	2	2	1	1	1							1		3	
CO3	2	2	1	1	1							1			3
CO4	2	2	1	1	1							1		3	
CO5	3	2	3	3	2								3		3
CO6	3	3	2	3	3									3	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Introduction to finite automata: Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata.

Regular Expressions, regular languages and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;

Context free Grammars and Normal forms: Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.

Push Down Automata and Turing Machine: Push down automata (PDA); Languages of a PDA;
Deterministic PDA; Turing Machine- Definition, Working principle of Turing machine; Construction of TM

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory, Languages and Computation”, 3rd Edition, Pearson Education, 2009.
2. Peter Linz, “An Introduction to formal Languages and Automata”, 4/ E, Jones and Bartlett Publishers, 2006.

REFERENCE BOOKS:

1. Kamala Krithivasan, Rama R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson, 2009.
2. B N Srinivasa Murthy, “Formal Languages and Automata Theory”, Sanguine Publishers, 2006.

JOURNALS/MAGAZINES:

1. https://theoryofcomputing.org/
2. https://www.journals.elsevier.com/theoretical-computer-science
3. https://www.springer.com/journal/224

SWAYAM/NPTEL/MOOCs:

1. https://www.edx.org/course/automata-theory
2. https://nptel.ac.in/courses/106/104/106104028/
3. https://ocw.mit.edu/courses/mathematics/18-404j-theory-of-computation-fall-2006/syllabus/

SELF-LEARNING EXERCISES:

Applications of Finite Automata and Applications of Regular Expressions.

Course Title	**Steganography and Digital Watermarking**				**Course Type**		**SC**	
Course Code	**B24EIS512**	**Credits**	**3**		**Class**		**V Semester**	
	LTP	Credits	Contact Hours	Work Load	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**				
	Practice	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	**42**		**50**	**50**

COURSE OVERVIEW:

This course provides an insight into the fundamentals of steganography and Watermarking. It will also discuss Digital Watermarking schemes, security, and authentication.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic principles, characteristics, various approaches, and applications of steganography.
2. Illustrate the knowledge of the basics of counter measures like steganalysis for assessing the data hiding methods.
3. Explain the basic principles, characteristics, various approaches, and applications of Digital Watermarking.
4. Illustrate the different Digital watermarking schemes.
5. Explain about watermark security and authentication.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the fundamental concepts, principles, characteristics, and performance measures of steganography.	1 to 5,9 10,12	1,2,3
CO2	Apply the concept of steganalysis for data hiding methods.	1 to 5,9 10,12	1,2,3
CO3	Summarize the basic principles, characteristics, various approaches, and applications of Digital Watermarking.	1 to 5,9 10,12	1,2,3
CO4	Outline the different Digital Watermarking Schemes.	1 to 5,9 10,12	1,2,3
CO5	Apply the various concepts of watermarking for digital authentication and authorization schemes related to electronic documents, image and video.	1 to 5,9 10,12	1,2,3
CO6	Analyze Applications and properties of watermarking and steganography.	1 to 5,9 10,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		ü				
CO2			ü			
CO3		ü				
CO4		ü				
CO5			ü			
CO6				ü		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2				2	2		2	3	2	2
CO2	3	3	3	2	2				2	2		2	3	2	2
CO3	3	3	3	3	2				1	2		2	3	3	2
CO4	3	3	1	1	1				2	2		2	3	2	1
CO5	3	3	3	2	2				2	2		2	3	2	2
CO6	3	3	3	2	2				1	1		1	3	2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Steganography

Basics and Importance of Steganography - Applications and Properties of Steganography - Steganography: LSB embedding, Steganography in palette images -Steganography in JPEG Images: JSteg data hiding in spatial and transform domain -Steganography Security, Minimizing the embedding impact – Steganalysis.

Fundamentals of Digital Watermarking

Importance of Watermarking - Application and Properties of Watermarking - Models of Watermarking - Basic Message Coding: Mapping Message into Message Vectors, Error Correction Coding - Watermarking with Side Information - Analysing Errors.

Digital Watermarking Schemes

Spatial Domain: Correlation-based Watermarking, Least Significant bit Watermarking - Frequency domain: Discrete Wavelet Transform Watermarking, Discrete Fourier Transform Watermarking, Discrete Cosine Watermarking, Quantization Watermarking, Haar Transform Watermarking, Hadamard Transform Watermarking - Robust Watermarking - Fragile and Semi-Fragile Watermarking.

Digital Watermarking Security and Authentication

Watermarking Security: Security Requirements, Watermark Security and Cryptography, Watermarking Attacks and Tools - Content Authentication: Exact Authentication, Selective Authentication, Localization, Restoration.

Self-Learning Component:

Perceptual models: Evaluating perceptual impact – General form of a perceptual model – Examples of perceptual models – Robust watermarking approaches - Redundant Embedding, Spread Spectrum Coding, and Embedding in Perceptually significant coefficients.

TEXT BOOKS:

1. J. Fridrich, Steganography in Digital Media: Principles, Algorithms, and Applications, 2010, 1st Ed. Cambridge: Cambridge University Press, United Kingdom. (ISBN No.: 978- 0-52-119019-0).
2. Frank Y. Shih, Digital Watermarking and Steganography Fundamentals and Techniques, 2020, 2nd Ed. CRC Press, United States. (ISBN No. : 9780367656430).
3. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, New York, 2008.

REFERENCE BOOKS:

1. I. J. Cox, M. L. Miller, J. A. Bloom, T. Kalker, and J. Fridrich, Digital Watermarking and Steganography, 2008, 2nd Ed. Amsterdam: Morgan Kaufmann Publishers In, United States. (ISBN No. : 978-0-12-372585-1).
2. P. Wayner, Disappearing Cryptography: Information hiding: Steganography and Watermarking, 2008, 3rd ed. Amsterdam: Morgan Kaufmann Publishers In, United States. (ISBN No. : 978-0-08-092270-6).
3. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, "Digital Watermarking", Margan Kaufmann Publishers, New York, 2003.

JOURNALS/MAGAZINES:

1. **https://www.ijraset.com/best-journal/image-steganography**
2. **https://novapublishers.com/shop/steganography-and-watermarking/**

SWAYAMNPTEL/MOOCs

1. https://www.amrita.edu/course/digital-watermarking/
2. https://onlinecourses.nptel.ac.in/noc19_ee55/preview

<table>
<tr><td>Course Title</td><td colspan="4">Natural Language Processing</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS513</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="3">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course provides a comprehensive introduction to Natural Language Processing (NLP), covering various levels of language processing and the computational challenges involved in working with natural languages. Students will explore real-life applications of NLP, including spell and grammar checkers, information extraction, machine classification, and will gain hands-on experience with the Natural Language Toolkit (NLTK).

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand NLP concepts and applications.
2. Provide a comprehensive knowledge of sentence structure in NLP and enable students to perform basic preprocessing of raw data.
3. Evaluate fundamental features and algorithms of Natural Language Processing (NLP), including parsing, POS tagging.
4. Apply NLP techniques and Describe role of Classifiers in Text processing.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain core NLP concepts, applications, corpora and datasets for NLP	1 to 5	1,3
CO2	Implement preprocessing of raw text and sentences from a corpus using both basic and customized techniques.	1 to 5	2
CO3	Identify and apply key features in NLP such as parsing, POS tagging, named entity recognition, n-grams, and bag-of-words.	1 to 5	2,3
CO4	Gain proficiency in applying basic mathematical concepts, linear algebra, probability, TF-IDF, vectorization, encoders, normalization, and probabilistic models.	1 to 5	1
CO5	Analyse the performance of different classifiers in Text processing	1 to 5	1,3
CO6	Apply different classification algorithm to solve real world problems.	1 to 5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√	√			
CO3		√	√			
CO4		√	√	√		
CO5		√	√	√		
CO6		√	√	√		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3							3	3	2	3
CO2	3	2	2	2	3							3	3	2	3
CO3	3	2	2	2	3							3	3	2	3
CO4	3	2	2	2	3							3	3	2	3
CO5	3	2	2	2	3							3	3	2	3
CO6	3	2	2	2	3							3	3	2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Natural Language Processing: Understanding Natural Language Processing, Understanding basic applications, Understanding advanced applications, Environment setup for NLTK.
Corpus and Dataset: what is corpus, why do we need corpus, Understanding corpus analysis, Understanding types of data attributes, Exploring different file format for corpora, Resources for accessing free corpora, Preparing a dataset for NLP applications, Web scraping.

Understanding Structure of a Sentences: Components of NLP, NLU, CFG, Morphological analysis, Syntactic analysis, Semantic analysis, Handling ambiguity, Discourse integration, Pragmatic analysis.
Preprocessing: Handling corpus raw text, Handling corpus raw sentences, Basic preprocessing, Practical and customized preprocessing.

Feature Engineering and NLP Algorithms: Features of NLP- Parser and Parsing, POS Tagging and Taggers, Named Entity Recognition, N gram, Bags of Words
Basic statistical features for NLP: Basic Mathematics, Basic concepts of linear algebra for NLP, Basic concepts of probabilistic theory for NLP, TF-IDF, Vectorization, Encoders decoders, Normalization, Probabilistic models.
Applications of NLP: Supervised classification- Gender classification, Document classification, PoS Tagging, Naïve Bayes, Decision trees, Information extraction, chunking, developing and evaluating chunkers.

Self Learning Component:

Extracting information from Text, Exploring the 20 Newsgroups with Text Analysis Algorithms, Stock Price prediction with Regression Algorithms,

Best Practices:
i) Data preparation stage
ii) Training sets generation stage
iii) Model training, evaluation and selection stage

TEXT BOOKS:

1. Jalaj Thanaki "Python Natural Language Processing – Explore NLP with Machine Learning and Deep Learning Techniques, Packt Media, Inc.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O'Reilly Media, Inc.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2018.
2. Sowmya Vajjala, Bodhisattwa Majumder " Practical Natural Language Processing- A comprehensive Guide to Building Real World NLP Systems", O'Reilly Media, Inc.
3. James Allen, "Natural Language Understanding", Benjamin-Cummings Publishing Co., Inc. Redwood City, CA, USA,1995.
4. Christopher Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT press, 1999.

JOURNALS/MAGAZINES:

1. ACM Transactions on Language Processing
2. Elsevier Journal of cognitive systems research
3. Computational Linguistics
4. Natural Language Engineering
5. ACM Transactions on Asian and Low-Resource Language Information Processing (TALLIP)
6. Natural Language Processing (NLP) News

SWAYAMNPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://nptel.ac.in/courses/106/106/106106211/
3. https://onlinecourses.nptel.ac.in/noc23_cs45/preview

SELF-LEARNINGEXERCISES:

Extracting information from Text, Exploring the 20 Newsgroups with Text Analysis Algorithms, Stock Price prediction with Regression Algorithms.

Best Practices:

i) Data preparation stage
ii) Training sets generation stage
iii) Model training, evaluation and selection stage

<table>
<tr><td>Course Title</td><td colspan="4">Basic VLSI Design</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td></td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This subject deals studying the basics of a VLSI design for computer science & engineering graduates . Here we study VLSI design from the beginning point for CSE students.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Learn the basics of VLSI design & fabrication.
2. Study the details of implementation of combitional logic in VLSI.
3. Understand the implementation details of sequentail logic in VLSI.
4. Introduce the concepts of floor planning and design styles.

COURSE OUTCOMES(COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study the fundamentals of VLSI circuits.	1,2,9,12	1,2
CO2	Design VLSI circuits using combinatorial circuits to realise different problems.	1,2,3,4,9,12	1,2

CO3	Implement sequential circuits in VLSI to design real time problems.	1,2,3,4,5,9,12	1,2,3
CO4	Learn the concepts of floor planning to accommodate the logic in silicon area.	1,2,9,12	1,2
CO5	Experiment the different VLSI circuits and identify the logic requirement of the same.	1,2,3,4,5,9,12	1,2,3
CO6	Illustrate different experiment setups using VLSI code with Intel Quartus	1,2,3,4,5,9,12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3			√			
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO# /	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	√	√							√			√	√	√	
CO2	√	√	√	√					√			√	√	√	
CO3	√	√	√	√	√				√			√	√	√	√
CO4	√	√							√			√	√	√	
CO5	√	√	√	√	√				√			√	√	√	√
CO6	√	√	√	√	√				√			√	√	√	√

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Introduction

Digital Systems and VLSI, Why Design Integrated Circuits?, Integrated Circuit Manufacturing, CMOS Technology, Integrated Circuit Design Techniques, IP-Based Design

Fabrication and Devices, Introduction, Fabrication Processes Transistors, Wires and Vias, Fabrication Theory and Practice Reliability, Layout Design and To

Combinational Logic

Logic Gates: Introduction, Combinational Logic Functions, Static Complementary Gates Switch Logic

Combinational Logic Networks: Introduction, Standard Cell-Based Layout, Combinational Network Delay, Logic and Interconnect Design

Sequential logic

Sequential Machines: Introduction, Latches and Flip-Flops, Sequential Systems and Clocking Disciplines, Performance Analysis, Clock Generation. Sequential System Design

Subsystem Design: Introduction, Combinational Shifters, Adders, ALUs, Multipliers

Floorplanning

Floorplanning: Introduction, Floorplanning Methods, Global InterconnectFloorplan Design, Off-Chip Connections

Architecture Design : Introduction, Hardware Description Languages, Register-Transfer Design Pipelining, High-Level Synthesis Architectures for Low Power

Text Book:

Modern VLSI design, Wayne Wolf, 4th edition, prentice hall

SWAYAM NPTEL/MOOCs:

1. https://nptel.ac.in/courses/117101058

Course Title	**Sensors, actuators for IoT interfacing**				**Course Type**		**SC**	
Course Code	**B24EIS521**	**Credits**	**3**		**Class**		**V Semester**	
Course Structure	**LTP**	Credits	Contact Hours	Work Load	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	42	**-**	**50**	**50**

COURSE OVERVIEW:

This course provides a comprehensive understanding of the principles, technologies, and applications of sensors and actuators in the context of the Internet of Things (IoT). Students will explore various types of sensors and actuators, learn how to interface them with IoT devices, and understand the data acquisition, processing, and control mechanisms required to build robust IoT systems. Practical lab sessions and projects will give hands-on experience with real-world IoT applications.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the fundamental concepts and types of sensors and actuators used in IoT.
2. Learn about the interfacing techniques and protocols for integrating sensors and actuators with IoT devices.
3. Develop skills to design and implement IoT systems incorporating sensor data acquisition and actuator control.
4. Analyze and process sensor data for effective decision-making in IoT applications.
5. Explore the use of sensors and actuators in various IoT domains, such as smart homes, healthcare, industrial automation, and environmental monitoring.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the working principles of different types of sensors.	1 to 5,9,12	1,2,3
CO2	Illustrate the working principles of different types of actuators.	1 to 5,9,12	1,2,3
CO3	Analyze the phenomena that define behavior of various sensors.	1 to 5,9,12	1,2,3
CO4	Analyze the phenomena that define behavior of various actuators.	1 to 5,9,12	1,2,3
CO5	Apply the concepts in common methods for converting a physical parameter into an electrical quantity.	1 to 5,9,12	2,3
CO6	Identify suitable sensors and actuator for real time applications	1 to 5,9,12	2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2		✓				
CO3				✓		
CO4				✓		
CO5			✓			
CO6			✓			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2									1					1
CO2	2									2					2
CO3			3							2					2
CO4			3							2					2
CO5	3									2					2
CO6	3									2					2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Sensors/Transducers, Principles, Classification, Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Inductive Sensors, Capacitive Sensors- Parallel plate & serrated plate types, Ultrasonic Sensors.

Thermal Sensors: Introduction, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Junction Semiconductor Types, Magnetic Sensors: Introduction, Sensors and the Principles Behind, Force & displacement Sensors.

Radiation Sensors: Introduction – Basic Characteristics – Types of Photo sensistors /Photo detectors– X-ray and Nuclear Radiation Sensors – Fiber Optic Sensors.

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, , Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Medical Diagnostic Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring

Self-Learning Component:

1.https://www.geeksforgeeks.org/actuators-in-iot/
2.https://www.geeksforgeeks.org/sensors-in-iot/

TEXT BOOKS:

1. D. Patranabis-Sensors and Transducers, PHI Learning Private Limited.
2. W. Bolton-Mechatronics, Pearson Education Limited

REFERENCE BOOKS:

1. Patranabis-Sensors and Actuators- 2 nd Ed., PHI, 2013.
2. Robert H. Bishop-The Mechatronics Handbook, 2nd Ed., Mechatronic Systems, Sensors and Actuators, fundamentals and modelling

JOURNALS/MAGAZINES:

1.**https://ieeexplore.ieee.org/document/8950961**
2.**https://www.mdpi.com/journal/jsan**

SWAYAMNPTEL/MOOCs

1. https://nptel.ac.in/content/syllabus_pdf/108108147.pdf

<table>
<tr><td>Course Title</td><td colspan="4">Cyber Law and Digital Forensics</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS522</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td></td><td></td><td></td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>--</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course gives an overview of cybercrime targeted at computer resources, computer networks and the internet. In addition, it provides various insights into interpersonal cybercrime and how cyberlaw frameworks are dealing with the same across the world. The course also includes the principles and concepts of digital forensics like digital investigations, data and file recovery methods, and digital forensics analysis and invalidation, digital forensics tools.

COURSE OBJECTIVE (S):

The objectives of this course are to:
1.Study various cyber laws and exclusively Indian evidence law.
2.Analyze the effectiveness of cyber laws in various aspects of cybercrimes.
3.Illustrate the need for computer forensics and apply tools in use.
4.Examine the cyber law application under a real time scenario.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the basic interface of technology and cyber law.	1,2,6,7,8,12	1,2
CO2	Infer various cyber laws and cybercrimes under Indian evidence law.	1 to 5,8,12	1,2
CO3	Articulate the need for computer forensics.	1to 3, 5,8,12	1,2
CO4	Analyze the utility of the cyber laws in different aspects of cybercrimes.	1 to 4,6,7 ,8,12	1,2,3
CO5	Apply a few computers forensic tools to a given scenario.	1 to 6,8,12	1,2,3
CO6	Evaluate the knowledge on cyber law and forensics in real life scenario.	1 to 6, 8,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3		√				
CO4				√		
CO5			√			
CO6					√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1			2	2	3				3	3	3	
CO2	1	1	1		1			3				2	3	3	
CO3	1	1	1		1			3				2	3	3	
CO4	1	1	2	1		2	2	3				2	3	3	3
CO5	1	1	2	1		2	2	2				2	3	3	3
CO6	1	1	2		3	2		3				2	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY:

Cyber Space: Fundamental definitions -Interface of Technology and Law – Jurisprudence and-Jurisdiction in Cyber Space - Indian Context of Jurisdiction - Enforcement agencies – Need for IT act - UNCITRAL – E-Commerce basics. Information Technology Act, 2000 - Aims and Objects — Overview of the Act – Jurisdiction

Cyber Crimes and Indian Evidence Law: Meaning of Cyber Crimes –Different Kinds of Cybercrimes – Cybercrimes under IPC, Cybercrimes under the Information Technology Act,2000 - Cybercrimes under International Law - Hacking Child Pornography, Cyber Stalking, Software Piracy, Violation of Privacy on Internet - Data Protection and Privacy – Indian Court cases.

Introduction to Computer Forensics: Understanding computer forensics, computer forensics versus other related disciplines, A brief History of computer Forensics, understanding case laws, developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations, Following the legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.

Current Computer Forensics Tools: Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software

Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Using a Write-Blocker.

TEXT BOOKS:

1. Nilakshi Jain , Ramesh Menon "Cyber Security and Cyber Laws" Willey Publishers, 1st Edition, October 2020.
2. Pavan Duggal "Cyber Security Law" ,2nd Edition,2019.
3. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016
4. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.

REFERENCE BOOKS:

1. Nhien-An Le-Khac , Kim-Kwang Raymond Choo "Cyber and Digital Forensic Investigations: A Law Enforcement Practitioner's Perspective" 2020 Edition
2. MarjieT.Britz, ―Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013.

JOURNALS/MAGAZINES:

1. https://heinonline.org/HOL/LandingPage?handle=hein.journals/glj103&div=13&id=&page=Sood,
2. Vivek. Cyber Law Simplified. Tata McGraw-Hill Education, 2001.
3. https://delhidistrictcourts.nic.in/ejournals/CYBER%20LAW.pdf
4. https://www.sciencedirect.com/science/article/pii/S1742287606000703
5. https://www.sciencedirect.com/science/article/pii/S0167404815001595

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/course/cyber-law-for-every-professional-dr-pavan-duggal-clu/
2. https://www.coursera.org/learn/digital-forensics-concepts
3. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

<table>
<tr><td>Course Title</td><td colspan="4">Big Data Analytics</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EIS523</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course introduces the concept of big data and provides a practical foundation level exposure that enables students to participate in big data application development. The course provides grounding in basic and advanced methods to big data technology with Apache Spark fundamentals.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the concepts of Big Data and its Business Implications.
2. Illustrate the fundamentals of functional programming for Big-Data Analytics.
3. Exemplifying the features of Apache Spark for Data Analytics.
4. Implement Machine Learning in Spark to solve real business problems.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the concepts of Big Data and its Business Implications.	1 to 5,9,10,12	1
CO2	Apply the concept of functional distributed programming to Big Data Analytics applications.	1 to 5, 9,10,12	1,2, 3
CO3	Understand the fundamentals of Apache Spark and Spark Core.	1 to 5, 9,10,12	1, 3
CO4	Design a Data Analytics Framework using Apache Spark with Python.	1 to 5, 9,10,12	1,2,3
CO5	Implement distributed Machine Learning Applications for big data using Spark.	1 to 5, 9,10,12	1,2,3
CO6	Develop real world big data application using Apache Spark with Python programming.	1 to 5, 9,10,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2			√			
CO3		√				
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	3	-	-	-	-	-	-	-	3	1	3
CO2	3	3	3	3	3	-	-	-	3	-	-	2	3	3	3
CO3	3	1	3	1	3	-	-	-	3	3	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3
CO6	3	3	3	3	3	1	-	1	3	3	3	3	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introducing Big Data, Hadoop, and Spark: Introduction to Big Data, Distributed Computing, and Hadoop, A Brief History of Big Data and Hadoop, Hadoop Explained; Introduction to Apache Spark: Apache SparkBackground, Uses for Spark, Programming Interfaces to Spark, Submission Types for Spark Programs, Input/Output Types for Spark Applications, The Spark RDD, Spark and Hadoop; Functional Programming Using Python: Data Structures Used in Functional Python Programming, Python Object Serialization, Python Functional Programming Basics; Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j

Understanding the Spark Cluster Architecture: Anatomy of a Spark Application: Spark Driver, Spark Workers and Executors, The Spark Master and Cluster Manager; Spark Applications Using the Standalone Scheduler: Spark Applications Running on YARN Deployment; Modes for Spark Applications Running on YARN: Client Mode, Cluster Mode, Local Mode Revisited; Learning Spark Programming Basics: Introduction to RDDs,Loading Data into RDDs, Creating an RDD from a File or Files, Methods for Creating RDDs from a Text File or Files, Creating an RDD from an Object File, Creating an RDD from a Data Source, Creating RDDs from JSON Files, Creating an RDD Programmatically;
Operations on RDDs: Key RDD Concepts, Basic RDD Transformations, Basic RDD Actions, Transformations on PairRDDs, MapReduce and Word Count Exercise, Join Transformations, Joining Datasets in Spark, Transformations on Sets, Transformations on Numeric RDDs; Advanced Programming Using the Spark Core API: Shared Variables in Spark: Broadcast Variables, Accumulators, Exercise: Using Broadcast Variables and Accumulators; Partitioning Data in Spark: Partitioning Overview, Controlling Partitions, Repartitioning Functions, Partition-Specific or Partition-Aware API Methods; RDD Storage

Options: RDD Lineage Revisited, RDD Storage Options, RDD Caching, Persisting RDDs, Choosing When to Persist or Cache RDDs, Checkpointing RDDs, Exercise: Checkpointing RDDs;
Processing RDDs with External Programs: Data Sampling with Spark; Understanding Spark Application and Cluster Configuration: Spark Environment Variables, Spark Configuration Properties; Optimizing Spark: Filter Early, Filter Often, Optimizing Associative Operations, Understanding the Impact of Functionsand Closures,

Considerations for Collecting Data, Configuration Parameters for Tuning and Optimizing Applications, Avoiding Inefficient Partitioning, Diagnosing Application Performance Issues; Machine Learning with Spark: Machine Learning Primer, Machine Learning Using Spark MLlib, Exercise: Implementing a Recommender Using Spark MLlib, Machine Learning Using Spark ML;

TEXT BOOKS:
1.Aven, Jeffrey. Data Analytics with Spark Using Python. Addison-Wesley Professional, 2018.
2.Bengfort, Benjamin, and Jenny Kim. Data analytics with Hadoop: an introduction for data scientists." O'Reilly Media, Inc.", 2016.
3.Sridhar Alla, Big Data Analytics with Hadoop 3, published by Packt Publishing Ltd, May 2018
4.SubhashiniChellappan, DharanitharanGanesan, Practical Apache Spark Using the Scala API, A Press, 2018.

REFERENCE BOOKS:
1.Michael Minelli, Michele chambers, AmbigaDhiraj: Big data, big analytics, Wiley, 2013.
2.P. Tan, M. Steinbach, V. Kumar, Introduction to Data Mining, Addison-Wesley, 2005.
3.J. Han, M. Kamber, Data Mining: Concepts and Techniques, 2nd ed. Morgan Kaufmann, 2005.

JOURNALS/MAGAZINES:
1.IEEE,Introduction to the IEEE Transactions on Big Data
2.Elsevier,Big data research journal Elsevier
3.Springer, Journal on Big Data Springer.
4.ACM DL,The Journal of Machine Learning Research-ACM

SWAYAM/NPTEL/MOOCs:
1.https://nptel.ac.in/courses/106104189
2.https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3.https://iisc.talentsprint.com/cds/?utm_source=googlesearch&utm_medium=tcpa&utm_campaign=ts-googlesearch-iisc-cds-tcpa-similar-audiences-roi&utm_content=data-science-program&utm_term=Analytics%20training%20courses&gclid=Cj0KCQjw8uOWBhDXARIsAOxKJ2HfWKGqqpZ7Gm0dBPDgkwWaj0BqSZBzuWvcqmbF5AOvYvxYSB5lvFcaAlO_EALw_wcB
4.https://www.simplilearn.com/pgp-data-engineering-certification-training-course?utm_source=google&utm_medium=cpc&utm_term=big%20data%20analysis%20online%20course&utm_content=11233548673-137256573987-586850068745&utm_device=c&utm_campaign=Search- DataCluster-PG-BigData-CDE-Purdue-IN-Main-AllDevice-adgroup-SEMR-09Mar2022-BD-Analysis-Course-Phrase&gclid=Cj0KCQjw8uOWBhDXARIsAOxKJ2GINP8K1hXBRF4Qu6cWTaZ714GQYvQR_CL4ff9qM6whNg_Xx2vLFmcaAjMTEALw_wcB

SELF-LEARNING EXERCISES:
1.SQL and NoSQL Programming with Spark
2. Stream Processing and Messaging Using Spark

<table>
<tr><td>Course Title</td><td colspan="4">System On Chip Design</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td></td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This subject deals studying the basics of a VLSI design for computer science & engineering graduates . Here we study VLSI design from the beginning point for CSE students.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Learn the basics of VLSI design & fabrication.
2. Study the details of implementation of combitional logic in VLSI.
3. Understand the implementation details of sequentail logic in VLSI.
4. Introduce the concepts of floor planning and design styles.

COURSE OUTCOMES(COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study the fundamentals of VLSI circuits.	1,2,9,12	1,2
CO2	Design VLSI circuits using combinatorial circuits to realise different problems.	1,2,3,4,9,12	1,2,3
CO3	Implement sequential circuits in VLSI to design real time problems.	1,2,3,4,9,12	1,2,3
CO4	Learn the concepts of floor planning to accommodate the logic in silicon area.	1,2,9,12	1,2
CO5	Experiment the different VLSI circuits and identify the logic requirement of the same.	1,2,3,4,9,12	1,2,3
CO6	Illustrate different experiment setups using VLSI code with Intel Quartus	1,2,3,4,5,9,12	1,2,3

BLOOM’S LEVELOF THECOURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3			√			
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	√	√							√			√	√	√	
CO2	√	√	√	√					√			√	√	√	√
CO3	√	√	√	√					√			√	√	√	√
CO4	√	√							√			√	√	√	
CO5	√	√	√	√					√			√	√	√	√
CO6	√	√	√	√	√				√			√	√	√	√

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

UNIT – I: Introduction

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Processors: Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

TEXT BOOKS:

1.Michael J. Flynn and Wayne Luk, “Computer System Design System-on-Chip”, Wiley India Pvt. Ltd.
2.Steve Furber, “ARM System on Chip Architecture “, 2nd Edition, 2000, Addison Wesley Professional.

REFERENCE BOOKS:

1.Ricardo Reis, “Design of System on a Chip: Devices and Components”, 1st Edition, 2004, Springer
2.Jason Andrews, “Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)”, Newnes, BK and CDROM.
3.Prakash Rashinkar, Peter Paterson and Leena Singh L, “System on Chip Verification – Methodologies and Techniques”, 2001, Kluwer Academic Publishers.

<table>
<tr><td>Course Title</td><td colspan="4">Data Science with Python Programming</td><td colspan="2">Course Type</td><td colspan="2">OE</td></tr>
<tr><td>Course Code</td><td>B24EFO511</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="3">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td></td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course introduces Python Programming fundamental components. Students are introduced to data structures, strings and file handling. This course includes an overview of Exception handling and Object-Oriented Programming Principles. In the course we also discuss useful python libraries such as numpy, pandas and matplotlib.

COURSE OBJECTIVE (S):

1. Learn the syntax and semantics of the Data science for Python programming language.
2. Illustrate the process of structuring the data using collections.
3. Demonstrate the use of built-in functions to navigate the file system.
4. Demonstrate the use of string in-built functions to work with text data.
5. Illustrate exception handling and Object-Oriented Programming concepts in Python.
6. Outline the usage of python libraries for working with arrays, data sets and representing data in the form of graphs/plots.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Illustrate basic python syntax and semantics.	1,2,3,4,5,12	1, 2, 3
CO2	Identify and use different data types and data structures in Python, such as lists, tuples, dictionaries, and sets.	1,2,3,4,5,12	1, 2, 3
CO3	Develop programs to handle a wide variety of tasks in Python programming that involve text and string data.	1,2,3,4,5,12	1, 2, 3
CO4	Demonstrate reading from and writing to files using Python.	1,2,3,4,5,12	1, 2, 3
CO5	Illustrate exception handling and outline the principles of object-oriented programming.	1,2,3,4,5,12	1, 2, 3
CO6	Analyze retrieved data with appropriate Python visualization libraries.	1,2,3,4,5,12	1, 2, 3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3			√			
CO4		√				
CO5		√				
CO6				√		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2							3	3	3	3
CO2	3	3	3	3	2							3	3	3	3
CO3	3	3	3	3	2							3	3	3	3
CO4	3	2	2	3	2							3	3	3	3
CO5	3	3	3	3	2							3	3	3	3
CO6	3	3	3	3	3							3	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT:

Fundamentals of Python Programming: Introduction to Python Features, Constants, Variables, Naming conventions, simple data types, indentation, operators and expressions, conditional statements, loops, functions, user defined functions, Working with Data Structures- Lists, tuples, sets and dictionaries.

Strings and File handling: Strings - definition, about Unicode, chr( ) and ord() function, creating strings, reading strings, slicing, concatenation and comparison of strings, string library functions. File Handling - definition, file access modes, reading text files and binary files, writing text files and binary files, file object attributes, file handling functions.

Exception Handling and Object-Oriented Programming concepts: Exception Handling - Definition of error and exception, difference between syntax error and exceptions, Try and Except Statement – Catching Exceptions, Catching Specific Exception, Try with Else Clause, finally keyword, Raising exception, NameError, TypeError, ZerDivisionError. Object Oriented Programming concepts- Definition of a class and object, class and object creation, self-parameter, constructors, modifying object properties, deleting object properties, OOP features - Encapsulation, Data abstraction, Inheritance, and polymorphism.

Python Libraries: NumPy - Basics of numpy, ndarray, dimensions in arrays, ndim attribute, ndmin attribute, accessing array elements, negative indexing, array slicing, array copy vs view, array shape, array reshaping, arange() function, matrix operations, universal array functions. Pandas - Basics of pandas, why use pandas, what can pandas do, Creation of DataFrame and Series, named indices, loc and iloc attribute, Load files into DataFrame. Matplotlib - Basics of matplotlib, features and advantages of matplotlib, Graphs/Plots.

Self-Learning Component:

Python SQL Database Access, seaborn, keras.

TEXT BOOKS:

1. Eric Mathes, "Python Crash Course, A Hands-on Project-Based Introduction to Programming", 2nd Edition, 2019.
2. Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly, 2nd Edition, 2020.
3. Michael Dawson, "Python Programming for the absolute Beginner", Cengage, 3rd Edition, 2020.

REFERENCE BOOKS:

1. Charles Dierbach, "introduction to Computer Science using Python", Wiley India Edition, 2015.
2. Allen B. Downey, "Think Python, How to think like a Computer Scientist", O'Reilly, 2nd Edition, 2017.
3. Mark Lutz, “Learning Python”, Oreilly. 2003.
4. Mark Pilgrim, “Dive into Python 3”, Apress special edition, second edition, 20l5.
5. T.R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
6. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning,, 1st Ed., 2012.
7. Michael Dawson, “Python Programming for the Absolute Beginners”, 3rd Edition, CENAGE Learning.
8. Paul Barry, Head First Python,by O'Reilly Media, Inc 2nd Edition Released November 2016.
9. Wesley J. Chun, “Core Python Programming”, 2nd Edition, Prentice Hall.

JOURNALS/MAGAZINES:

1. IEEE Transactions on Artificial Intelligence
2. Journal of Machine Learning Research
3. Foundations and Trends in Machine Learning
4. Synthesis Lectures on Artificial Intelligence and Machine Learning
5. ACM Transactions on Intelligent Systems and Technology

SWAYAM NPTEL/MOOCs:

1. Python for Data Science, Prof. Ragunathan Rengasamy, IIT Madras.
2. The Joy of Computing using Python, Prof. Sudarshan Iyengar, IIT Ropar.

Course Title	Database Management System				Course Type		OE	
Course Code	B24EFO512	Credits	3		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

This course introduces topics such as conceptual data modelling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basics of Database Management System.
2. Demonstrate the use of Relational model and Relational algebra.
3. Illustrate the use of different SQL statements in query processing.
4. Discuss the importance of optimal Database Design with Normalization.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize and exemplify fundamental nature and characteristics of database systems.	1 to 5,9 10,12	1,2
CO2	Model and design solutions for efficiently representing and querying data using relational model.	1 to 5,9.10,12	1,2
CO3	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	1 to 5,9,10,12	1,2,3
CO4	Construct the database for given real world application and solve queries over it using SQL commands.	1to 5,9,10,12	1,2
CO5	Develop an optimized database using design guidelines and normalization technique.	1to 5,9,10,12	1,3

CO6	Construct the physical and logical database designs, database modeling, relational, hierarchical, and network models.	1to 5,9,10,12	2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6		√				

COURSE ARTICULATIONMATRIX:

CO#/	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2				3	3		1	3	3	
CO2	3	3	2	3	1				3	3		1	3	3	
CO3	3	3	2	3	3				3	3		1	3	3	3
CO4	3	3	2	3	1				3	3		1	3	3	
CO5	3	2	3	3	3				3	3		1	3		3
CO6	3	3	2	3	3				3	3		1		3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to databases and Conceptual Modelling: Introduction to database, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues. Introduction to various database tools and framework (commercial and open source)

Relational Data Model and Relational algebra: Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra.

SQL:SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, Retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.

Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, and Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

Self Learning Component:

Transaction, Basic terminologies, ACID properties

TEXTBOOKS:

1. Elmasri and Navathe, “ Fundamentals of Database Systems”, Pearson Education, 5th Edition, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, McGraw-Hill, 3rd Edition, 2003.
3. Phill Pratt, “Concepts of Database Management, Cengage Learning”, 8th Edition, 2014
4. Jeffrey A Hoffer, “Modern Database Management, Pearson”, 12th Edition, 2015

REFERENCEBOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: “Database System Concepts”, 6th Edition, McGraw Hill, 2010.
2. C J Date, “Database Design and Relational Theory: Normal Forms and All that Jazz”, O ‘Reilly, April 2012.
3. James Martin, “Principles of Database Management Systems”, 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering

5. Elsevier Data and Knowledge Engineering
6. ACM Transactions on Database Systems

JOURNALS/MAGAZINES:

1. http://www.ijstr.org/final-print/june2019/Database-Management-System.pdf
2. https://www.dbjournal.ro/

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/courses?query=database%20management
2. https://onlinecourses.swayam2.ac.in/cec19_cs05/preview
3. https://www.edx.org/learn/databases
4. https://www.classcentral.com/course/swayam-data-base-management-system-9914

<table>
<tr><td>Course Title</td><td colspan="4">Computer Networks lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EF0504</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE DESCRIPTION:

This course introduces to networking and Internet protocols via programming and hands-on labs using different tools viz. ns3, NMAP, packet tracer. The concept learnt are understood more clearly pertaining to TCP/IP protocol architecture; user datagram protocol (UDP); multicasting; transmission control protocol (TCP); standard Internet services, and protocol usage by common Internet applications. Sockets programming; client/server; peer-to-peer; Internet addressing; TCP sockets; UDP sockets; Router and switch configurations, network topology, wireless internetworking, Network protocol analyzers; traffic generation

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the ns3 simulator, installation and its application.
2. Illustrate the creation of point to point link, TCP, UDP protocols its connection.
3. Demonstrate the connection establishment of network computing devices.
4. Discuss tracking, testing, analyzing the network.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the protocol stacks (OSI and TCP/IP) used for data communication	1 to 5,9,10,12	1,3
CO2	Analyze the connection establishment of network computing devices using Packet tracer	1 to 5, 9,10,12	1,3
CO3	Develop a program for star topology in C++ and understand data transfer with NetAnim	1 to 5, 9,10,12	2, 3
CO4	Make use of TCP dump to understand and analyze the network characteristics	1 to 5, 9,10,12	1,3
CO5	Apply NMAP to understand network behavior for spurious activity	1 to 5, 9,10,12	1,3
CO6	Demonstrate the wireshark tool for protocol analysis	1 to 5, 9,10,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4					√	
CO5				√		
CO6					√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				3	3		2	3		3
CO2	3	3	2	2	1				3	3		2	3		3
CO3	3	3	2	2	2				3	3		2	1	1	3
CO4	3	3	3	1	2				3	3		2	1	-	3
CO5	3	2	2	2	3				3	3		2	3		3
CO6	3	2	2	3	3				3	3		2	3	2	3

Note: 1-Low, 2-Medium, 3-High

PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Write a NS3 program to connect two nodes with a point to point link, which have unique interface. Analyze the network performance using UDP client server.	NS3(Installed with NetAnim), Wireshark.	Understand to establish point to point network. Create an interface to point to point link. Anylize the Network performance usibg client server
2	Write a NS 3 program to demonstrate bus topology. Analyze the performance using UDP based applications.	NS3(Installed with NetAnim), Wireshark.	Create Bus Topology. Analyze the performance using UDP based applications.
3	Write a NS3 program to implement FTP using TCP bulk transfer, Analyze the performance	NS3, Wireshark.	Impliment FTP protocol to analyze the flow of bulk transfer. Anlyze the performance of Application Protocols.
4	Write a NS3 program to connect two nodes with a point to point link, which have unique interface. Analyse the traffic control using TCP by changing suitable parameters.	NS3, Trace Matices, Wirushark	Create Point to point link with unique interface. Analyze the flow of traffic control of Application Protocols.
5	Write NS 3 Program to configure two nodes on an 802.11b physical layer, with802.11b NICs in adhoc mode, and by default, sends one packet of 1000 (application) bytes to the other node. The physical layer is configured to receive at a fixed RSS (regardless of the distance and transmit power); therefore, changing position of the nodes has no effect. Analyze the performance.	NS3(Installed with NetAnim and Wifi Libraries)	Implement the wireless Technology in Adhoc mode. Analyze the performance by changing the position of nodes.
6	Install wireshark, and analyze the packets using it on a selected interface. Apply filters and check the packets.	Wireshark, I/O Graph Tools.	Install the wireshark tool for packet analysis. Apply the filters and analyze the packet parameters.
7	Install packet tracer, and consider a topology and configure VLAN	Packet Tracer	Install the Packet tracer. Create and Configure a simple Virtual Local Area Network(VLAN)
8	Simulate the protocols ARP and DNS using Cisco Packet Tracer.	Packet Tracer	Demonstrate the working of ARP and DNS Protocols.
9	Simulate the protocols FTP and SMTP using Cisco Packet Tracer.	Packet Tracer	Demonstrate the working of FTP and SMTP Protocols.
10	Install NMAP, and execute atleast 10 commands to demonstrate the scanning of networks hosts and ports.	NMAP, Commands to Scan the system.	Install Nmap in both Windows and Ubantu Platform. Demonstrate the scanning of networks hosts and ports using suitable commends.

TEXTBOOKS:

1. Klaus Wehrle, “Modeling and Tools for Network Simulation”, 4th Edition, Springer.
2. Behrouz A Forouzan, “Data Communications and Networking”, 5th Edition, McGraw – Hill, 2016.

REFERENC BOOKS:

1. Nader F. Mir, “Computer and Communication Networks”, Pearson Education, 2009.
2. Dr Anil Kumar Rangisetti, “Advanced Network Simulations Simplified: Practical guide for wired, Wi-Fi (802.11n/ac/ax), and LTE networks using ns-3”.

JOURNALS/MAGAZINES:

1. **https://www.nsnam.org/documentation**
2. **https://nmap.org/docs.html**
3. **https://www.wireshark.org/docs/wsug_html**

Course Title	**IoT Systems Processors Lab**				**Course Type**		**HC**	
Course Code	**B24EI0503**	**Credits**	**1**		**Class**		**V Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture							
	Tutorial	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	1	2	2				
	Total	1	2	2	-	28	25	25

COURSE OVERVIEW:

This lab course exposures the students to basic programming in ESP32 micro controller. In this lab the students will do programs related to interfacing the boards with ESP32 along with real world application. The students are expected to do a project with ESP32 processor end of the course.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Study the fundamental of ESP32 microcontroller.

2. Program to interface ESP32 with LED and other sensors.

3. Develop a real world application by using the communication features of WiFi.

4. Create application invovling the cloud network

COURSE OUTCOMES(COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSO
CO1	Explain the fundamentals of ESP32 micro controller to interface different components/ devices.	1,2,3,4,5	1,3
CO2	Experiment ESP32 module with Display devices.	1,2,3,5	1,3
CO3	Build the programs using DHT and soil moisture sensor with ESP32.	1,2,3,5	1,3
CO4	Develop the programs to control the motor using ESP32.	1,2,3,5	1,3
CO5	Evaluate the solutions for existing cloud networking problems using ESP32.	1,2,3,5	1,3
CO6	Illustrate the learning outcome of IoT applications on the assigned projects/ experiments.	1,2,3,4,5,11,12	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5					√	
CO6		√				

COURSE ARTICULATION MATRIX

CO#/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2								2		2
CO2	3	3	2		2								2		2
CO3	3	2	3		2								2		2
CO4	2	3	2		2								2		2
CO5	2	2	2		3								2		2
CO6	2	2	2	2	3						2	3	2		2

Note:1-Low,2-Medium,3-High

Practice :

Sl. No	Title Of Experiment	Tools Used	Expected Skills / Activity
1.	Create a program to interface LED's with ESP32 micro controller. The LED's should be glowing alternatively.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
2.	Write a program using ESP32 micro controller to display a message moving curtail display using LCD	Arduino IDE and ESP controller	Programming using ESP32 micro controller
3.	Develop a ESP32 program to measure the humidity and temperature using sensors.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
4.	Develop a ESP32 program to simulate smart garden maintenance.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
5.	Develop a ESP32 program to create a smart room lighting system.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
6.	Develop a ESP32 program to control the speed of a DC motor.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
7.	Write a program to transfer a file from one device to another using WiFi module and ESP32 device.	Arduino IDE and ESP controller	Programming using ESP32 micro controller
8.	Develop a program using ESP32 device to interface the cloud network to access data in a mobile device.	Arduino IDE and ESP controller	Programming using ESP32 micro

			controller
A simple mini project is expected end of the course using ESP32 module 1. IOT based traffic control system 2, IOT based web app 3. IOT based motion sensor 4. Micro card reader 5. Bluetooth based application			

Text Book:

1. Internet of Things Projects with ESP32, Agus Kurniawan, Packt Publishing • March 2019

REFERENCE BOOKS:

1. Developing IoT Projects with ESP32, Packt Publishing, Sept 2021.

2. Advanced IOT, Packt Publishing, Feb 2020.

3. Internet of Things Projects with ESP32, Packt Publishing, Mar 2019

SWAYAM NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106105166
2. https://nptel.ac.in/courses/106105195

Course Title	**Web Technology lab**				**Course Type**		**HC**	
Course Code	**B24EI0504**	**Credits**	**1**		**Class**		**V Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Workload**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture	-	-	-				
	Tutorial	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50**	**50**

COURSE DESCRIPTION:

The Web Technology Lab provides hands-on experience in developing dynamic and interactive websites using modern web technologies. Students will learn essential programming languages, frameworks, and tools to create responsive and user-friendly web applications.

COURSE OBJECTIVE (S):

1. Analyze the foundational concepts of web development, including HTML, CSS, client-side scripting, and server-side scripting, to assess their strengths, weaknesses, and applications in real-world scenarios.
2. Evaluate various techniques and tools for creating dynamic and interactive web content using JavaScript and PHP, synthesizing this knowledge to develop innovative solutions that meet specific user needs and requirements.
3. Utilize client-side scripting languages such as JavaScript to add interactivity and dynamic functionality to web pages, including form validation, event handling, and DOM manipulation.
4. Implement server-side scripting using PHP to handle form submissions, interact with databases, and process data, ensuring efficient and secure data management in web applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply semantic markup techniques to enhance the accessibility and create HTML tables and forms with appropriate structure and styling.	1,2,3,4,5,10,12	1,2
CO2	Evaluate the effectiveness of CSS styles in enhancing webpage layout with design and analyze the accessibility and responsiveness of CSS layouts across different devices.	1,2,3,4,5,10,12	1,2
CO3	Apply JavaScript functions to manipulate the Document Object Model (DOM) and develop interactive web forms with validation and event handling using JavaScript.	1,2,3,4,5,10,12	1,2
CO4	Analyze the performance and compatibility of JavaScript implementations across different web browsers.	1,2,3,4,5,10,12	1,2
CO5	Understand the basic concepts of server-side development with PHP.	1,2,3,4,5,10,12	1,3
CO6	Analyze the efficiency and scalability of PHP scripts in accessing and managing MySQL databases.	1,2,3,4,5,10,12	1,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom’s Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2					✓	
CO3			✓			
CO4				✓		
CO5		✓				
CO6				✓		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	1	3					2		2	3	3	
CO2	2	3	3	3	3					3		2	3	3	
CO3	3	3	3	1	3					2		2	3	3	
CO4	1	3	3	3	3					1		2	3	3	
CO5	3	1	1	1	3					1		2	3		3
CO6	3	3	3	3	3					1		2	3		3

Note: 1-Low, 2-Medium, 3-High

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	A. Create a webpage to showcase the departments of a prestigious university, "University of Excellence," using various types of lists. The university has several faculties, each with multiple departments. You need to organize this information effectively on the webpage. Write a HTML program for the demonstration of types of Lists (Unordered List, Ordered List, Definition List, Nested List) to display the above given scenario. B. Using HTML and CSS, create a time-table display based on the following requirements: 1. Use an HTML table to list each day of the week (Monday to Friday) as column headers. 2. Include rows for each class offered, displaying the class name along with its scheduled timings for each day of the week. 3. Ensure that the time-table is visually appealing and easy to read, with appropriate styling for headers, rows, and cells.	**Sublime**	**HTML and CSS**

	4. Implement responsiveness in your design so that the time-table adjusts gracefully when viewed on different devices (desktops, tablets, and smartphones).		
2	Consider a local community center that offers various workshops and classes. They want to launch an online registration system for participants to sign up for upcoming events. The center requires a user-friendly registration form on their website to collect essential information from participants efficiently. Write a HTML program to develop a static Registration Form that meets the following requirements: A. Include fields for the participant's full name, email address, phone number, and their choice of workshop/class they wish to register for. B. Implement appropriate input types and placeholders to guide users (e.g., text, email, select dropdown). C. Apply basic styling using CSS to ensure the form is visually appealing and easy to use.	**Sublime**	**HTML and CSS**
3	Demonstrate the use of cascading stylesheets (Embedded stylesheets, External stylesheets and Inline styles) with an HTML example that achieves the following: 1.Basic Styling: Apply CSS to style headings, paragraphs, and links uniformly across all pages of the bookstore website. 2.Navigation Menu: Design a horizontal navigation menu using CSS for easy navigation between different sections of the website (e.g., Home, Books, About Us, Contact). 3.Responsive Design: Implement CSS media queries to ensure the website adapts smoothly to different screen sizes, making it mobile-friendly. 4.Font and Color Scheme: Choose a suitable font family and color scheme that aligns with the bookstore's branding and enhances readability.	**Sublime**	**CSS**
4	Create a calculator interface using HTML and CSS involves designing a visual layout that mimics the functionality and appearance of a traditional calculator as below.	**Sublime**	**HTML, CSS and Java script**

	 5789541257*653		
5.	Implementing JavaScript validation for both the user login page and the registration form to ensure data integrity and user security. 1. User Login Page Validation: Implement JavaScript validation for the user login page. Include the following requirements: - Ensure both username and password fields are filled out before allowing form submission. - Validate that the username follows a specific format (e.g., alphanumeric characters only, minimum length). - Display appropriate error messages if any validation criteria are not met. - Upon successful validation, simulate a login process (e.g., redirect to a welcome page or display a success message). 2. Registration Form Validation: Develop JavaScript validation for the registration form. Consider the following aspects: - Validate that all required fields (e.g., full name, email, password) are filled out correctly. - Verify the email format (e.g., using regular expressions to check for a valid email pattern). - Ensure the password meets security criteria (e.g., minimum length, inclusion of both letters and numbers). - Display real-time feedback for users as they fill out the form (e.g., indicating strength of password). - After successful validation, submit the form data securely.	**Sublime**	**HTML and Java script**
6	a. Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.	**Sublime**	**Javascript**

	b. Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.		
7	a. Write a PHP program to store current date-time in a COOKIE and display the ‘Last visited on’ date-time on the web page upon reopening of the same page. b. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.	**Sublime**	**PHP and Java script**
8	Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.	**Sublime**	**PHP and Java script**

Project			
No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc. b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.	**Sublime**	HTML and Perl
2	Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.	**Sublime**	HTML and Perl

TEXT BOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development”, Pearson Education India, 1st Edition, 2016
2. Dean, J., Web Programming with HTML5, CSS, and JavaScript. Jones & Bartlett Learning, 2018
3. Minnick, C. Beginning ReactJS foundations building user interfaces with ReactJS: An App

REFERENCE BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 1st Edition, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2007.
3. HTML & CSS: The Complete Reference Thomas A. Powell, , Fifth Edition, Tata McGraw Hill.
4. Harvey M Deitel, Paul J Deitel and Tem R Nieto, Internet and World Wide Web How to Program, Pearson, 6th Edition, 2020.
5. Rebah, H.B., Boukthir, H. and Chedebois, A., Website Design and Development with HTML5 and CSS3. John Wiley & Sons, 2022.

6. Robin Nixon, “Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5”, O’Reilly Publications, 4th Edition, 2015.
7. Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Pearson Education, 5th Edition 2016.
8. Nicholas C Zakas, “Professional JavaScript for Web Developers”, Wrox/Wiley India, 3rd Edition 2012.

JOURNALS/MAGAZINES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview
2. An Analysis of the Latest Features and Trends in HTML5 by Smith, A. et al. (Journal of Web Engineering, 2023)
3. Recent Advances in CSS3 Layout Techniques by Patel, S. (ACM Transactions on the Web, 2023)
4. Comparative Analysis of Popular JavaScript Frameworks for Modern Web Development" by Garcia, M. et al. (Journal of Software Engineering Research and Development, 2023)
5. State of JavaScript Frameworks: A Comprehensive Survey by Kim, H. et al. (ACM Computing Surveys, 2022)
6. ReactJS: Trends, Challenges, and Future Directions by Gupta, S. et al. (Journal of Web Development, 2023)
7. Optimizing ReactJS Performance: Best Practices and Techniques by Zhang, L. et al. (IEEE Software, 2022)
8. PHP 7: New Features and Performance Improvements by Rodriguez, J. et al. (Journal of Systems and Software, 2023)
9. Securing PHP 7 Applications: Current Challenges and Solutions by Martinez, E. et al. (Information and Software Technology, 2022).

<table>
<tr><td>Course Title</td><td colspan="4">AEC-3 (Ability Enhancement Course - Placement Training)</td><td colspan="2">Course Type</td><td colspan="2">AEC</td></tr>
<tr><td>Course Code</td><td>B24EF0507</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW

Placement training classes can effectively be conducted as a part of an Ability Enhancement Course (AEC). These courses are designed to enhance students' skills, making them more prepared and competitive for the job market.

Course Title	**Indian Knowledge System**				**Course Type**		**MC**	
Course Code		**Credit**	**0**		**Class**		**V semester**	
Course Structure	**LTP**	**Credit**	**Contact Hours**	**Work Load**	**Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	0	1	1				
	Tutorial	-	-	-	Theory	Practical	**CIE**	**SEE**
	Practical	-	-	-				
	Total	**0**	**1**	**1**	**14**	**-**	**25**	**25**

COURSE OVERVIEW:

The Indian Knowledge Systems comprise of Jnan, Vignan, and Jeevan Darshan that have evolved out of experience, observation, experimentation, and rigorous analysis. This tradition of validating and putting into practice has impacted our education, arts, administration, law, justice, health, manufacturing, and commerce. This has influenced classical and other languages of Bharat, that were transmitted through textual, oral, and artistic traditions. “Knowledge of India” in this sense includes knowledge from ancient India and, its successes and challenges, and a sense of India’s future aspirations specific to education, health, environment and indeed all aspects of life.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To provide a roadmap for systemic study of Indian knowledge system
2. To introduce students to the science and technological advancements related to Indian tradition.
3. To help students understand the Indian architecture, fine arts and agricultural system.
4. To help learners understand India’s rich legacies influence on the world heritage

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Gain conceptual understanding of Indian culture and traditions.	6,8,10	
CO2	Appreciate the science and technological advancements in ancient India.	6,8,10	
CO3	Describe various ancient theories related to health, well- being and mindfulness	6,8,10	
CO4	Comprehend the Indian architecture, town planning, art and music.	6,8,10	
CO5	Understand India as a land united by cultural diversity.	6,8,10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2	✓					
CO3	✓					
CO4	✓					
CO5	✓					
CO6	✓					

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2		2		2					
CO2						2		2		2					
CO3						2		2		2					
CO4						2		2		2					
CO5						2		2		2					
CO6						2		2		2					

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Introduction to IKS

Bharatavarsha-A Land of Rare Natural Endowments: Largest cultivable area in the world. Protected and nurtured by Himalayas. The Sindhu-Ganga plain and great coastal plains.

The great rivers of India-Abundant rains, sunshine and warmth, vegetation, animals and mineral wealth. Most populous country in the world. India's prosperity held the world in thrall. Splendid geographical isolation of India and the uniqueness of Indian culture.

Culture – Indus Valley Civilization and early cultural practices, The Vedic culture, Influence of Buddhism and Jainism on Indian Culture, Influence of Islam and Christianity, Indian Cultural Renaissance of the 19th Century

Foundational literatures-Vedas, Ramayana, Mahabharata and the Puranas

Contribution of ancient India to Mathematics, Astronomy and Health Science

Development of Science in Ancient India- Mathematics, Astronomy and Health Science.

Mathematics- Numbers, fractions and geometry in the Vedas. Decimal nomenclature of numbers in the Vedas Zero and Infinity Simple constructions from Sulba-sutras.Science- Kanad, Varahamihira, Nagarjuna. Important texts of Indian mathematics Brief introduction to the development of algebra, trigonometry and calculus.

Astronomy- Ancient records of the observation of the motion of celestial bodies in the Vedic corpus. Sun, Moon, Nakshatra & Graha. Astronomy as the science of determination of time, place and direction by observing the motion of the celestial bodies. The motion of the Sun and Moon. Motion of equinoxes and solstices Elements of Indian calendar systems as followed in different regions of India.

Health Science- Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases. Basic concepts of Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu. The importance of Agni (digestion). Six Rasas and their relation to Doshas Ayurvedic view of the cause of diseases. Dinacharya or daily regimen for the maintenance of good health, Ritucharya or seasonal regimen Important Texts of Ayurveda Selected extracts from Astängahrdaya (selections from Sätrasthana) and Susruta-Samhita (sections on plastic surgery, cataract surgery and anal fistula).

TEXT BOOKS:

1. Sundararajan K.R., Hindu Spirituality - Vedas through Vedanta, Cross Road Publications, New York, 1997.
2. Griffiths Bede, Yoga and the Jesus Prayer Tradition, Asian Trading Corporation, Bangalore, 1992
3. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998
4. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.
5. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018
6. Baladev Upadhyaya, Samskrta Sastrom ka lihas, Chowkhambha, Varanasi, 2010.
7. D. M. Bose, S. N. Sen and B. V Subbarayappa, Eds, A Concise History of Science in India, 2nd Ed. Universities Press, Hyderabad, 2010.
8. Astangahrdaya, Vol 1. Sutrasthana and Sarirasthana, Translated by K. R. Srikantha Murthy.Vol. I, Krishnadas Academy. Varanasi, 1991.
9. Dharampal, Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
10. JK. Bajaj and M. D Srinivas, Indian Economy and Polity in Eighteenth century Chengalpattu, in J. K. Bajaj ed., Indian Economy and Polity, Centre for Policy Studies, Chennai, 1995, pp. 63-84.
11.. J. K. Bajaj and M. D Srinivas, Annam Bahu Kurvita Recollecting the Indian Discipline of Growing and Sharing Food in Plenty, Centre for Policy Studies, Chennai, 1996.

VI SEMESTER

VI Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EF0601	Cryptography and Network Security	HC	3	0	0	3	3	50	50	100	PCC
2	B24EF0602	Agile Software Development and DevOps	HC	3	0	0	3	3	50	50	100	PCC
3	B24EI0601	Block Chain Technology	HC	3	0	0	3	3	50	50	100	PCC
4	B24EI0602	Machine Learning and Applications	HC	3	0	0	3	3	50	50	100	PCC
5	B24EIS61X	Professional Elective-5	SC	3	0	0	3	3	50	50	100	PEC
6	B24EFO61X	Open Elective-2	OE	3	0	0	3	3	50	50	100	OE
7	B24EF0605	Cryptography and Network Security Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B24EI0603	Block Chain Technology Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B24EI0604	Machine Learning and Applications Lab	HC	0	0	1	1	2	25	25	50	PCC
10	B24EI0605	Mini Project	HC	0	0	2	2	4	50	50	100	Proj
11	B24EI0606	AEC-4 (Placement Training)	AEC	0	0	1	1	2	25	25	50	AEC
TOTAL				**18**	**0**	**6**	**24**	**30**	**450**	**450**	**900**	
TOTAL SEMESTER CREDITS					**24**							
TOTAL CUMULATIVE CREDITS					**135**							
TOTAL CONTACT HOURS					**30**							
TOTAL MARKS					**900**							

Course Title	Cryptography and Network Security				Course Type		HC	
Course Code	B24EF0601	Credits	3		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

This course will emphasize on principles and practice of cryptography and network security: classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers), linear and differential cryptanalysis, perfect secrecy, public-key cryptography algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes and email security, viruses, firewalls, digital right management, and other topics. In this course students will learn as aspects of network security and cryptography

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of cryptography.

2. Describe public key cryptography and message authentication.

3: Demonstrate the key distribution using Symmetric or Asymmetric encryption.

4. Discuss security applications in the field of Information technology.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the fundamental concepts of cryptography	1 to 5	1
CO2	Use symmetric and asymmetric key algorithms for cryptography	1 to 5	2
CO3	Apply the key distribution technique using Symmetric or Asymmetric encryption	1 to 5	2,3
CO4	Develop real-world security applications in the field of Information technology.	1 to 5	2,3
CO5	Understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.	1 to 5	1,2
CO6	Apply the System security concepts for real-time secure applications	1 to 5	2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3			√			
CO4						√
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**2**	**2**	**2**	**2**	**1**								**3**		
CO2	**3**	**2**	**3**	**1**	**2**									**3**	
CO3	**3**	**1**	**2**	**2**	**3**									**3**	**3**
CO4	**2**	**2**	**2**	**1**	**1**									**3**	**3**
CO5	**3**	**2**	**3**	**2**	**1**								**3**	**3**	
CO6	**2**	**1**	**2**	**2**	**2**									**3**	**3**

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

INTRODUCTION: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security.

CLASSICAL ENCRYPTION TECHNIQUES: Overview of Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, and Stenography.

INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat’s and Euler’s Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms.

TOOLS DEMONSTRATION: Wireshark, Metasploit, Snort, Nmap, Kali Linux.

SYMMETRIC KEY CRYPTOGRAPHY: Block Cipher Principles, Data Encryption Standards, Advanced Encryption Standards, Block Cipher Modes of Operation, Stream Cipher and RC4.

PUBLIC KEY CRYPTOGRAPHY: Principles Public key crypto Systems, RSA algorithm, Key Management, Diffie Hellman Key Exchange, Overview of Elliptic Curve Cryptography.

MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, List of Hash Function, Secure Hash Algorithm, HMAC, CMAC, an overview of Digital Signature.

AUTHENTICATION APPLICATION: Kerberos, X.509 Authentication Service, Public Key Infrastructure.

EMAIL SECURITY: Pretty Good Privacy

(PGP) and S/MIME**. IP SECURITY:**

Overview, IP Security Architecture.

SYSTEM SECURITY: Intrusion Detection, Overview of Packet Sniffing, Penetration testing, Database testing, DoS attacks. Password Management, Virus, and threats, Virus Countermeasures.

FIREWALLS: The Need for Firewalls, Firewall Characteristics, Types of Firewalls.

SELF-LEARNING EXERCISES:

The student is expected to study more about the following topics: IoT complexity leads to security issues and further DDoS attacks, Malware, Cloud security, Roles of AI and machine learning in cyber security.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson, Sixth edition, 2013
2. Behrouz A. Forouzan, "Cryptography and Network Security", McGraw Hill, 2007.

REFERENCE BOOKS:

1. William Stallings, "Network Security Essentials Applications and Standards", Fourth edition, Prentice Hall, 2011.
2. Joseph MiggaKizza," Guide to Computer Security, Springer Science & Media Inc., Third edition, 2015
3. Andrew S.Tanenbaum, "Computer Networks", Pearson, Fifth edition, 2015.
4. AtulKahate, "Cryptography and Network Security", McGraw Hill, 2013.

JOURNALS/MAGAZINES:

1. Springer Journal of Cryptographic Engineering, ISSN 2190-8508
2. ACM, ACM- International Journal of Applied Cryptography, ISSN:1753-0563
3. IEEE, IEEE Transactions on Information Forensics and Security.
4. Elsevier, Journal of Information Security and Applications.

SWAYAM/NPTEL/MOOCs:

1. Foundations of Cryptography: https://nptel.ac.in/courses/106/106/106106221/
2. Cryptography and Network Security: https://nptel.ac.in/courses/106/105/106105162/

Course Title	**Agile Software Development and DevOps**				**Course Type**	**HC**	
Course Code	**B24EF0602**	**Credits**	**3**		**Class**	**VI Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**	**Assessment in Weightage**	
	Lecture	**3**	**3**	**3**			
	Tutorial	**0**	**0**	**0**	**Theory**	**CIE**	**SEE**
	Practical	**-**	**-**	**-**			
	Total	**3**	**3**	**3**	**42**	**50**	**50**

COURSE OVERVIEW:

The course provides students with a knowledge on the basic principles of software development life cycle, activities involved in software requirements engineering, software development, testing, evolution and maintenance. It introduces concepts such as software processes and agile methods and essential software development activities. New methods to approach old development problems with DevOps.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1.Discuss the importance of the software development process using agile.
2.Demonstrate the workflow of Automating process.
3.Explain the development of a software product using Agile method.
4.Illustrate with the introduction and importance of DevOps concepts with a case study.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply software development process to solve complex problems in software engineering.	1,2	1,2
CO2	Make use of Agile principles for rapid software development and automation.	1,3	3
CO3	Summarize the basic principles of agile approach and need of integration, delivery and deployment.	1,3,5	1
CO4	Apply the concepts of agile life cycle modeling and automation in real world applications.	1,3,5,8	2,3
CO5	Distinguish between the traditional SDLC and agile ALM model for efficient and effective product delivery.	1,3,4	1
CO6	Develop the real-world applications using DevOps tools for continuous business improvement.	1,3,4,5,8,9	2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			√			
CO2			√			
CO3		√				
CO4			√			
CO5				√		

CO6			√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3	3	
CO2	3		3												3
CO3	3		3		2								3		
CO4	3		3		3			2						3	3
CO5	3		3	3									3		
CO6	3		3	3	2			3	3					3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY:

Requirements and Development process: Software Processes: Models, Process iteration, Process activities. Software Requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements Engineering Processes: Feasibility studies, Requirements elicitation and analysis.

Agile Application Life Cycle Management: Goals of Agile Application Life Cycle Management, Why Is Agile ALM Important? Understanding the Paradigm Shift, Rapid Iterative Development, Focus on12 Agile Principles, Agile Manifesto, scrum, XP, Fixed Time box Sprints, Customer Collaboration, Requirements and Documentation, Control the Flow: Sprint iteration, overview, Sprint Planning, Sprint Reviews, Sprint Retrospectives, Sprint Planning.

Automating the agile ALM: Goals of Automating the Agile ALM, Why Automating the ALMIs Important, Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, Automating the Workflow, Process Modeling Automation, Managing the Lifecycle with ALM, Broad Scope of ALM Tools, Achieving Seamless Integration, Managing Requirements of the ALM, Creating Epics and Stories, Systems and Driven Development, Environment Management, Gold Copies, Supporting the CMDB, Supporting Operations, Incident Management, Project Management, Planning the PMO, Planning for Implementation, Evaluating and Selecting the Right Tools, Defining the Use Case, Training Is Essential, Vendor Relationships, Keeping Tools Current.

DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps in Dev, Fully Automated Deployment, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, Continuous Integration and Continuous Delivery, Automated testing using Selenium, UFT, version control using Git, QA and DevOps, Information Security, Infrastructure as Code, Docker Containerization, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement, DevOps on Cloud.

TEXTBOOKS:

1. BobAiello and LeslieSachs, “Agile Application Life Cycle Management Using DevOps to Drive Process Improvement”, Addison Wesly, First printing, 2016.
2. Martin, R.C., Agile Software Development: Principles, Patterns, and Practices, Pearson Education Publisher, 2011.

REFERENCE BOOKS:

1. Ken Schwaber, Agile Project Management with Scrum, 2014,1st edition, Microsoft Press US.
2. Roman Pichler, Agile Product Management with Scrum: Creating Products that Customers Love, 2011, First edition, Addison-Wesley.
3. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O Reilly.
4. DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017.
5. Roger S, “Software Engineering-A Practitioner’s Approach”, seventh edition, Pressman, 2010.
6. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: By Sricharan Vadapalli, Packt, 2018.

JOURNALS/MAGAZINES:

1. IEEE Transactions on Software Engineering.
2. Journal of Software Engineering Research and Development.
3. International Journal of Agile and Extreme Software Development.
4. A decade of agile methodologies: Towards explaining agile software development.
5. Journal of Systems and Software.
6. IEEE Transactions on Software Engineering.

SWAYAM NPTEL/MOOCs:

1. https://www.mooc-list.com/course/agile-project-management-coursera
2. https://openclassrooms.com/en/courses/4544621-learn-about-agile-project-management-and-scrum
3. https://www.coursera.org/learn/devops-culture-and-mindset
4. https://www.coursera.org/learn/uva-darden-continous-delivery-devops

<table>
<tr><td>Course Title</td><td colspan="4">Blockchain Technology</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0601</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VI semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Blockchain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable, and distributed database called blockchain. Blockchains can be used to record and transfer any digital asset, not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the emerging abstract elements of Blockchain and Distributed Ledger Technology.
2. Describe the operational and functional aspects of cryptocurrency ecosystem.
3. Demonstrate the Smart Contract Basics interaction with users.
4. Discuss the various blockchain platforms for real world applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the basic principles of blockchain technology and the essential components of a blockchain network, such as nodes, miners, consensus mechanisms, and smart contracts.	1 to 8	1,2
CO2	Illustrate the cryptographic techniques used in blockchains to secure data and transactions.	1 to 8	1,2
CO3	Describe the attributes of the blockchain technology used by Ethereum and Bitcoin.	1 to 8	1,2
CO4	Compare the performance of various mining Consensus algorithm.	1 to 8	1,2
CO5	Understand the use of Hyperledger to build various application on blockchain.	1 to 8	1,2,3
CO6	Identify and apply the features of Block chain technology in real world application across various industries.	1 to 8	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3			√			
CO4			√			

CO5		√	√			
CO6			√	√		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	1	2	1	2					3	3	
CO2	3	3	1	3	1	2	1	2					3	3	
CO3	3	3	2	3	3	2	1	2					3	3	
CO4	3	3	2	3	3	2	1	2					3	3	
CO5	3	3	3	3	1	2	1	2					3	3	2
CO6	3	3	2	3	1	2	1	2					3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Blockchain: The History of blockchain and Bitcoin, Types of Blockchain, Consensus, CAP theorem and Blockchain, Decentralization using Bitcoin, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart Contracts, Decentralized Organization, Platform for decentralization, Attacks on Blockchains.

Blockchain Cryptography: Privacy and Security on Block chain, Hash Functions, Digital Signature Algorithm. **Introduction to Bitcoin**: Bitcoin definition, Digital Keys and addresses, Transactions, Blockchain structure, Mining, Proof-of-Work(POW), Bitcoin Network, Wallets.

Introduction to Ethereum: Ethereum blockchain, The Ethereum Network, components of the Ethereum Ecosystem, Keys and addresses, Accounts, Transaction and message, Ether Cryptocurrency, The Ethereum Virtual Machine, Smart Contracts, Proof-of-Stake (POS).

Introduction to Hyperledger: Hyperledger as a protocol, the reference Architecture, Requirements and design goals of Hyperledger Fabric, Hyperledger Fabric, Blockchain services, Consensus service: Byzantine Fault Tolerance (BFT), distributed ledger, Chain code. **Use cases**: Blockchain in Financial Software and system, Blockchain for Government and Blockchain in trade supply chain.

Self Learning Component:

1. Development Tools and Frameworks.
2. Web3 for Block chain Technology.

TEXTBOOKS:

1. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing. 2018
2. Lorne Lantz& Daniel Cawrey ,”Mastering Blockchain,Unlocking the power of Cryptocurrencies,Smart contract and Decentralixed Application”,O’reilly Publication,2021.
3. Treccani,A.,Lipton ,A, Blockchain and Distributed Ledgers:Mathematics,Technology, and Economics-First Edition,Singapore:World Scienfific Publishing Company,2021.

REFERENCE BOOKS:

1. Aravind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder,” Bitcoin and Cryptocurrency Technologies-a Comprehensive Introduction”, Princeton University Press,2016.
2. Antony Lewis, “The Basics of Bitcoins and Blockchains-An Introduction to Cryptocurrencies and the Technology that powers them”, Mango Publishing, 2018.

3. Andreas M. Antonopoulos, Dr. Gavin Wood, “Mastering Ethereum -Building Smart Contracts and dApps”, Ethereum Book LLC,2019.
4. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press.
5. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

JOURNALS/MAGAZINES:

1. https://soliditylang.org/
2. https://hyperledger-fabric.readthedocs.io/en/release-1.4/prereqs.html
3. https://platon-truffle.readthedocs.io/en/v0.1.0/
4. https://trufflesuite.com/docs/
5. https://docs.metamask.io/
6. https://remix-ide.readthedocs.io/en/latest/
7. https://geth.ethereum.org/docs
8. https://readthedocs.org/projects/web3js/
9. https://web3js.readthedocs.io/en/v1.10.0/
10. https://holbrook.no/share/doc/ethereum/web3js/1.0.0/
11. https://docs.web3js.org/
12. https://framework.embarklabs.io/docs/overview.html

SWAYAMNPTEL/MOOCs

1. https://onlinecourses.nptel.ac.in/

Course Title	**Machine Learning and Applications**				**Course Type**		**HC**	
Course Code	**B24EI0602**	Credits	**3**		**Class**		**VI semester**	
	LTP	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

The course aims to provide students with a comprehensive understanding of machine learning techniques, algorithms, and their applications. It covers both theoretical concepts and practical implementations using Python libraries.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Understand different learning algorithms and the techniques of data exploration
2. Apply machine learning algorithms to real-world problems
3. Illustrate supervised machine learning techniques that are suitable for applications
4. Evaluate model performance and make informed decisions based on data analysis

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understanding of Machine Learning Fundamentals	1,2,3,5,11,12	1,2,3
CO2	Identify the importance of Data Preprocessing Techniques	1,2,3,4,5,9,11,12	1,2,3
CO3	Analyze and evaluate the performance of machine learning experiments	1,2,3,4,5,6,9,11,12	1,2,3
CO4	Apply the concepts of supervised machine learning algorithms to predict the output class labels	1,2,3,5,12	1,2,3
CO5	Demonstrate probability based learning techniques to predict the solutions for real world problems.	1,2,3,4,5,9,11,12	1,2,3
CO6	Compare biological neuron and artificial neuron	1,2,3,4,5,6,9,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2			✓			
CO3				✓	✓	
CO4			✓			
CO5		✓				
CO6				✓		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		3						3	3	3	3	2
CO2	3	2	3	3	3				3		3	3	3	2	3
CO3	3	2	3	3	3	2			3		3	3	3	2	3
CO4	3	3	3		3							3	3	3	3
CO5	3	2	3	3	3				3		3	3	3	2	3
CO6	3	2	3	3	3	2			3		3	3	3	2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTs

Introduction:
Introduction to ML – Human Learning Vs Machine Learning - ML Types, Life cycle of ML, Preprocessing: Data Cleaning – Handling Missing & outliers - Data Transformation - Normalization – Standardization - Feature Extraction – Feature Encoding – Log Transformation – Label & One-hot Encoding – Sampling – Oversampling – Undersampling – Resampling – Data Splitting - Dimensionality Reduction : PCA – Data Visualization – Data Analysis - Python libraries: Scikit-learn - numpy – pandas – matplotlib -seaborn

Performance Measures & Error correction: Confusion Matrix – Precision - Recall – Entropy - F-score – Z-Score- MAE - MSE - RMSE – MAD - R2 - ROC - AUC - Hypothesis testing - Confidence intervals - P-value - Scedasticity **-** Normal distribution - Chi-Square – Cross-validation - Regularization, Bias-Variance Trade off

Supervised Machine Learning: Regression**:** Linear – Multi Linear – SVM - Ensemble Methods: Bagging – Boosting – Stacking
Classification: KNN - Naïve Bayes – Decision Tree - Random Forest - Gradient descent – Case Study – Python libraries: Scikit-learn

Unsupervised Machine Learning: Clustering: K Means - HMM - DBSCAN – Hierarchal – Agglomerative – Perceptrons - Forward Feature Selection - Backward Feature Elimination – Multilayer Perceptrons - Introduction to Neural Networks - ANN - Python libraries: TensorFlow – Keras - Case Study

Self Learning Component:
Reinforcement Machine Learning - CNN – RNN - neurolab – ffnet

Textbooks:

1. "Introduction to Machine Learning" by Ethem Alpaydin, 3rd Edition, published by The MIT Press in 2014.
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, 2nd Edition, published by O'Reilly Media in 2019.
3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop, 1st Edition, published by Springer in 2006.
4. "Python for Data Analysis" by Wes McKinney, 2nd Edition, published by O'Reilly Media in 2017.

Reference Books:

1. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy, 1st Edition, published by The MIT Press in 2012.
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 1st Edition, published by The MIT Press in 2016.
3. "The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, 2nd Edition, published by Springer in 2009.

4. "Python Data Science Handbook" by Jake VanderPlas, 1st Edition, published by O'Reilly Media in 2016.

Journals/Magazines:

1. "IEEE Transactions on Pattern Analysis and Machine Intelligence" - Published by IEEE Computer Society.
2. "Journal of Machine Learning Research" - Published by JMLR.
3. "Data Mining and Knowledge Discovery" - Published by Springer.
4. "Neural Networks" - Published by Elsevier.
5. "International Journal of Computer Vision" - Published by Springer.
6. "Journal of Artificial Intelligence Research" - Published by AI Access Foundation.

SWAYAMNPTEL/MOOCs

1. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
2. NPTEL course: "Machine Learning for Engineering and Science Applications" - This course covers basics to advanced concepts in machine learning with practical applications.
3. Coursera course: "Machine Learning" by Andrew Ng - An introductory course covering the fundamentals of machine learning algorithms and their applications.

Course Title	**IoT architecture and protocols**				**Course Type**		**SC**	
Course Code	**B24EIS611**	**Credits**	**3**		**Class**		**VI semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**-**	**50**	**50**

COURSE OVERVIEW:

The "IoT Architecture and Protocols" course provides a comprehensive introduction to the architecture, protocols, and technologies that form the backbone of the Internet of Things (IoT) ecosystem. This course covers the essential components, communication standards, and network protocols that enable the seamless integration and communication of IoT devices. Students will gain a thorough understanding of how IoT systems are designed, deployed, and managed, focusing on both theoretical concepts and practical applications.

COURSE OBJECTIVE (S):

The objective of this course is to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Comprehend the essentials of IoT and its applications	1to5	1,2
CO2	Understand the concepts of IoT Architecture Reference model and IoT reference architecture	1to5	1,2
CO3	Analyze various IoT Application layer Protocols.	1to5	2,3
CO4	Apply IP based protocols and Authentication Protocols for IoT	1to5	2,3
CO5	Describe the architectural views of IoT and various design challenges	1to5	1,2,3
CO6	Design IoT-based systems for real-world problems.	1to5	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom’s Level**					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		L2				
CO2		L2				
CO3				L4		
CO4			L3			
CO5					L5	
CO6						L5

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2										
CO2	3	3	3	2	2										
CO3	2	3	2	1	1										
CO4	3	3	2	2	2										
CO5	1	2	2	3	3										
CO6	1	2	3	3	3										

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:

Introduction to IOT, Applications of IOT, Use cases of IOT

The IoT Architectural Reference Model as Enabler, IoT in Practice: Examples: IoT in Logistics and Health, IoT Reference Model: Domain, information, functional and communication models;

IoT Reference Architecture: Architecture, Functional, information, deployment and operation views; SOA based Architecture, API-based Architecture, OPENIoT Architecture for IoT/Cloud Convergence.

Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP. SCADA, WebSocket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4.

Case study: Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System.

TEXT BOOKS:

1. Bassi, Alessandro, et al, “Enabling things to talk”, Springer-Verlag Berlin An, 2016.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
3. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.
4. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

REFERENCE BOOKS:

1. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security Perry Lea

JOURNALS/MAGAZINES:

1. https://onlinelibrary.wiley.com/doi/abs/10.1002/cpe.4946
2. https://link.springer.com/article/10.1007/s40031-021-00632-3
3. https://link.springer.com/article/10.1007/s40031-021-00632-3
4. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
5. https://onlinecourses.swayam2.ac.in/ntr24_ed01/preview

<table>
<tr><td>Course Title</td><td colspan="4">Cyber Security Assessment and Risk Analysis</td><td>Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B24EIS612</td><td>Credits</td><td colspan="2">3</td><td>Class</td><td colspan="2">VI semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>50</td><td>50</td></tr>
</table>

Course Overview:

This course describes the concepts of risk management and analysis in information security. It also covers the various Contingency Planning components. It will also discuss incident response options, and design an Incident Response Plan for sustained organizational operations

Course Objectives:

The objectives of this course are to:

1. Describe the concepts of risk management in information security.
2. Differentiate various Contingency Planning components with examples.
3. Define and be able to discuss incident response options, and design an Incident Response Plan for sustained organizational operations
4. Insights of Information security planning and governance in any organization

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the concept of Cyber security and its importance, history, impact with respect to Information Systems	1,2,4	1,2
CO2	Outline the insights of basic security concepts, terminology of Information Systems and its use.	2,3,8	1,2
CO3	Analyze Sources and motivation of cyber vulnerability and threats	3,5,10	2,3
CO4	Explain Information security planning and governance	3,5,8,12	2,3
CO5	Apply risk analysis, evaluation and mitigation methods.	2,3,5,12	1,3
CO6	Plan a Disaster Recovery for any sustained organizational operations.	3,5,8	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2		√				
CO3				√		
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX

CO# /POS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	3	2		2									2	2	
CO2		3	2					3					2	2	
CO3			2		2					2				2	
CO4			3		2			3				3		2	
CO5		2	2		2							2	2		
CO6			2		2			2						2	

Note: 1-Low, 2-Medium, 3-High

Course Content

Information Security Overview

Introduction: Introduction to Information Security, History and Understanding the Information system, basics of information systems, Impact of information system.

Building Blocks of Information Security: Introduction, Basic principles of Information Security, security related basic terms and definitions, three pillars of Information security, Information classification, criteria and terms for classification, Information security risk analysis.

Threats and Vulnerability of a System

Threats: Cyber threat categorization, sources, motivation, type, technical vs. non-technical (e.g. attacks to cooling systems to disrupt cyber systems), threat actors, exploitation of cyber vulnerabilities leading to impact and associated likelihood.

Vulnerabilities: Sources of cyber vulnerability, complexity of modern software, attack surface of modern systems, development of software for functionality and not with security considerations, existing known and zero-day system vulnerabilities, vulnerability databases and open information.

Security Planning

SECURITY INVESTIGATION: Need for Security - Business Needs - Threats – Attacks - secure software development - Legal, Ethical and Professional Issues in Information Security.

PLANNING FOR SECURITY: Information security planning and governance – policy and practices- blue print for security – training and awareness – continuity strategies

Risk Management

Risk evaluation and associated selection of risk treatment options, effects and selection of risk avoidance, mitigation, transfer, acceptance (or a combination thereof), risk management as an iterative process, risk profile stemming from modifications in an organisation's environment, building an organisation's cybersecurity control environment from the results of risk analysis, introduction to basic cybersecurity controls. Case study on security planning and management in any organizations.

Text Books/Reference Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd. , 2011
2. 2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithms, Applications, and Perspectives, CRC Press, 2018.
3. 3. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&F Group, 2013.
4. 4. John W. Rittinghouse and William N. Hancock "Cyber Security Operations handbook", Elsevier, 2003
5. Stallings, Cryptography and network security: Principles and practice, 5 th Edition, Upper Saddle River, NJ: Prentice Hall., 2011
6. C. Kaufman, r. Perlman, & M. Speciner, Network security: Private communication in a public world, 2 nd Edition, Upper Saddle River, NJ:Prentice HalL, 2002
7. C. P. Pfleeger, S. L. Pfleeger, Security in Computing, 4 th Edition, Upper Saddle River, NJ:Prentice Hall, 2007
8. T4. M. Merkow, & J. Breithaupt, Information security: Principles and practices. Upper Saddle River, NJ:Prentice Hall, 2005
9. .Information System Security best practices framework- Nina Godbole- John Willey
10. 2. "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", by Evan Wheeler

REFERENCE BOOKS:

1. Gary McGraw, Software Security: Building Security In, Addison-Wesley, 2006

JOURNALS/MAGAZINES:

SWAYAMNPTEL/MOOCs

SWAYAM/NPTEL/MOOCs: 1. Introduction to Cyber Security | Coursera 2. Cryptography and Network Security - Course (nptel.ac.in)

SELF-LEARNING EXERCISES:

Machine Learning in Cyber Security

Course Title	**Edge Computing**				**Course Type**		**SC**	
Course Code	**B24EIS613**	**Credits**	**3**		**Class**		**VI semester**	
Course Structure	**LTP**	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	**42**	**0**	**50**	**50**

COURSE OVERVIEW:

This course brings computation and data storage closer to the location where it is needed, improving response times and saving bandwidth. This course covers the architecture, technologies, and applications of edge computing, including its role in IoT, latency reduction, and data processing. It explores key concepts like edge devices, edge nodes, and the integration of cloud and edge. Additionally, the course examines the challenges and solutions related to security, scalability, and resource management in edge environments.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Introduce the IoT enabling technologies, New Computing Paradigms and addresses the Challenges in Federating Edge Resources
2. Describes the System Modeling and Research Challenges
3. Illustrates to manage and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds
4. Imparts the knowledge of Edge Analytics and Edge Data Storage Security
5. Demonstrate the knowledge applications of Fog and Edge Computing

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Interpret technologies behind the communication and management of fogs and edge resources.	1-4,11,12	1,2
CO2	Build the techniques for storage and computation in fogs, edges, 5G and clouds.	1-4,11,12	1,2
CO3	Illustrate the Edge Analytics , Edge Data Storage Security , Edge Computing Use Cases and Case Studies	1-5,11,12	1,2,3
CO4	Analyze the performance and issues of the applications developed using fog and edge architecture.	1-5,6	1,2,3
CO5	Make use of the popular frameworks and tools for edge computing technology.	1-5,11,12	1,2,3
CO6	Apply the security and privacy concerns for edge applications in various domains.	1-5,6,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3		√				
CO4				√		
CO5			√			
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3							3	3	3	2	
CO2	3	3	3	3							3	3	3	3	
CO3	3	3	3	3	2						3	3	3	3	2
CO4	3	3	3	3	2	2							3	3	2
CO5	3	3	3	3	3						3	3	3	3	2
CO6	3	3	3	3	2	2					3	3	3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Internet of Things (IoT) and New Computing Paradigms: Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Advantages of FEC: SCALE, How FEC Achieves these Advantages: SCANC, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges

Addressing the Challenges in Federating Edge Resources:-The Networking Challenge, The Management Challenge, Miscellaneous Challenges

Integrating IoT + Fog + Cloud Infrastructures and Management and Orchestration of Network Slices in 5G, Fog,Edge, and Clouds

Introduction ,Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use-Case Scenarios, Integrated C2F2T Literature by Metrics. Management and Orchestration of Network Slices in 5G, Fog,Edge, and Clouds : 5G, Cloud Computing, Mobile Edge Computing (MEC), Edge and Fog Computing, Network Slicing in 5G, Infrastructure Layer, Network Function and Virtualization Layer, Service and Application Layer, Slicing Management and Orchestration (MANO),Network Slicing in Software-Defined Clouds

Edge Analytics , Edge Data Storage Security , Edge Computing Use Cases and Case Studies (2nd Book)

Types of Data, Data Analytics, Goals of Data Analytics, Domains Benefiting from Big Data Analytics ,Real-Time Applications of Data Analytics, Phases of Data Analytics, Types of Data Analytics, Edge Data Analytics, Potential of Edge Analytics, Architecture of Edge Analytics, Machine Learning for Edge Devices , Edge Analytics: Case Study, Edge Data Storage Security, Data Security, Data Confidentiality, Authentication, Privacy-Preserving Schemes, Edge-Based Attack Detection and Prevention, Edge Computing Use Cases and Case Studies: Use Cases, Edge Computing High-Potential Use Cases, Realization of Edge Computing in Healthcare Ensuring Storage Security: Devices and Setup, Case Study I: Pulse Oximeter to Detect ARDS in Edge Server

Applications of Fog and Edge Computing

Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications, Testing Perspectives of Fog-Based IoT Applications, Legal Aspects of Operating IoT Applications in the Fog

TEXT BOOKS:

1. Fog and Edge Computing Principles and Paradigms Edited by Rajkumar Buyya and Satish Narayana Srirama- first published 2019 © 2019 JohnWiley & Sons, Inc, Wiley.
2. Edge Computing Fundamentals, Advances and Applications By K. Anitha Kumari, G. Sudha Sadasivam, D. Dharani, M. Niranjanamurthy, Taylor & Francis, CRC Press 2021

REFERENCE BOOKS:

1. Edge Computing for IoT and IIoT Technologies: In-depth Industry Use Cases and Practical Applications by Ajith Singh copyright 2019-20
2. IoT and Edge Computing for Architects - Second Edition by Perry Lea

JOURNALS/MAGAZINES:

1.https://ieeexplore.ieee.org/abstract/document/7488250
2.https://ieeexplore.ieee.org/abstract/document/7786106
3.https://www.sciencedirect.com/science/article/abs/pii/S1084804519301651
4.https://link.springer.com/chapter/10.1007/978-981-16-0733-2_14

SWAYAMNPTEL/MOOCs

1.https://onlinecourses.nptel.ac.in/noc24_cs66/preview
2.https://nptel.ac.in/courses/106104449
3.https://onlinecourses.nptel.ac.in/noc23_cs65/preview

SELF-LEARNINGEXERCISES:

1.Basic of Fog and Cloud computing

Course Title	**Multi Core Architecture & Programming**				**Course Type**	**SC**	
Course Code	**B24EIS614**	**Credits**	**3**		**Class**	**VI Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**	**Assessment in Weightage**	
	Lecture	**3**	**3**	**3**			
	Tutorial	**0**	**0**	**0**	**Theory**	**CIE**	**SEE**
	Practice	**0**	**-**	**-**			
	Total	**3**	**3**	**3**	**42**	**50**	**50**

COURSE OVERVIEW:

This course gives a glance into introduction to multi core architecture and programming a multi core system. It gives a brief insight into the different parallel programming environment variables and problem like dead lock, live lock etc. The subject also deals with parallel programming concepts and multi threaded programming to make a output much better using open MP and MPI.

COURSE OBJECTIVE (S):

The objective of this course is to:

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms.
- To develop multicore programs and design parallel solutions.

COURSE OUTCOMES(COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe multicore architectures and identify their characteristics and challenges.	1,2,9,12	1,2
CO2	Identify the issues in programming Parallel Processors.	1,2,9,12	1,2
CO3	Write programs using OpenMP and MPI. • Understand MPI derived datatype and its performance evaluation.	1,2,3,4,9,12	1,2

CO4	Design parallel programming solutions to common problems.	1,2,3,4,9,12	1,2
CO5	Compare and contrast programming for serial processors and programming for parallel processors	1,2,9,12	1,2
CO6	Understand MPI derived datatype and its performance evaluation.	1,2,9,12	1,2

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2		√				
CO3			√			
CO4			√			
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**Po12**	**PSO1**	**PSO 2**	**PSO3**
CO1	√	√							√			√	√	√	
CO2	√	√							√			√	√	√	
CO3	√	√	√	√					√			√	√	√	
CO4	√	√	√	√					√			√	√	√	
CO5	√	√							√			√	√	√	
CO6	√	√							√			√	√	√	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

MULTI-CORE PROCESSORS

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

PARALLEL PROGRAM CHALLENGES

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

SHARED MEMORY PROGRAMMING WITH OpenMP

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

DISTRIBUTED MEMORY PROGRAMMING WITH MPI

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

Self Learning Modules

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TEXT BOOKS:

1. Peter S. Pacheco, ―An Introduction to Parallel Programming‖, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, ―Multicore Application Programming for Windows, Linux, and Oracle Solaris‖, Pearson, 2011 (unit 2)

REFERENCES:

1. Michael J Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill,2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

JOURNALS/MAGAZINES

1. IEEE Transactions on Parallel and Distributed Systems
2. Springer International Journal of Parallel Programming
3. Elsevier Journal of Parallel and Distributed Computing

SWAYAM/NPTEL/MOOCS:

1. https://onlinecourses.nptel.ac.in/noc22_cs110/preview

Course Title	**Augmented Reality And Virtual Reality**				**Course Type**		**OE**	
Course Code	**B24EFO611**	**Credits**	**3**		**Class**		**VI Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50**	**50**

COURSE OVERVIEW:

This course covers basic concepts of augmented reality and virtual reality. The course also introduces the student to the working of multiple models of input and output interface in VR. The course also helps the student to understand development tools and frameworks in VR. Further, this course helps the student to work on the application of VR in digital entertainment

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the principles and multidisciplinary features of Virtual Reality.
2. Illustrate the multimodal user interaction and perception in Virtual Reality.
3. Demonstrate the use of objects for managing large scale Virtual Reality environment in real time.
4. Discuss the various solutions using Virtual Reality system framework and development tools for industry and social relevant applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Identify the components of Augmented and Virtual Reality	1 ,10 1	1
CO2	Apply multimodal user interaction and perception techniques involved in Virtual Reality.	1 to 3,5,10	3
CO3	Develop real world applications using Simulation and Interactive techniques.	1 to 3, 10	2,3
CO4	Choose the innovative Virtual Reality solutions for industrial and social relevant applications.	1,10	1
CO5	Make use of unity3D to develop innovative project.	1 to 3, 10	2,3
CO6	Apply VR modeling techniques to solve real world applications.	1,2,10	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3									3			3		
CO2	3	3	3		3					3					3
CO3	3	3	3							3				3	3
CO4	3									3			3		
CO5	3	2	2							3				3	3
CO6	3	2								3			3	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Augmented Reality (AR): Definition and Scope, A Brief History of Augmented Reality, Examples, Related Fields, System Structure of Augmented Reality, Key Technology in AR.
Introduction to Virtual Reality (VR): Fundamental Concept and Components of VR, Primary Features and Present Development on VR.

Core Technologies of AR: Computer Vision: Image recognition, feature tracking, and environmental understanding, 3D Modeling, and Registration: Creating and integrating 3D objects in real-time,
Display Technologies: Head-mounted displays (HMDs), AR glasses, and other interfaces, Tracking and Registration: Marker-based and markerless tracking techniques

Environment Modelling in VR: Geometric Modelling, Behaviour Simulation, Physically Based Simulation.
Interactive Techniques in VR: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Development Tools and Frameworks in AR/VR: Frameworks of Software Development Tools in AR/VR, X3D Standard, Vega, MultiGen, Virtools, and Unity.
Application of AR/VR in Digital Entertainment: AR/VR Technology in Film and TV Production, Healthcare, VR Technology in Physical Exercises and Games, Demonstration of Digital Entertainment by VR.

Self Learning Component:
Unity 3D, Manus VR, Blender

TEXT BOOKS:

1. Dieter Schmaltzier and Tobias Hollerer,"Augmented Reality: Principles and Practice", Addison-Wesley, 2006.
2. Burdea, G. C. and P. Coffet. ,"Virtual Reality Technology", Second Edition. Wiley-IEEE Press, 2003/2006.

REFERENCE BOOKS

1. Sherman, William R. and Alan B. Craig, “Understanding Virtual Reality – Interface, Application, and Design”, Morgan Kaufmann, 2002.
2. Fei GAO, “Design and Development of Virtual Reality Application System”, Tsinghua Press, March 2012.
3. Guangran LIU, “Virtual Reality Technology”, Tsinghua Press, Jan. 2011.

JOURNALS/MAGAZINES:

1. **https://www.mdpi.com/journal/electronics/special_issues/VR_AR**
2. **https://www.sciencedaily.com/releases/2020/04/200420145025.htm**
3. **https://www.springer.com/journal/10055**

SWAYAMNPTEL/MOOCs

1. **https://nptel.ac.in/courses/106/106/106106182/**
2. **https://www.classcentral.com/course/augmented-reality-virtual-reality-mixed--10508**
3. **https://www.edx.org/learn/augmented-reality**

Course Title	Data Communications and Systems				Course Type		OE	
Course Code	B24EFO612	Credits	3		Class			
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42		50	50

COURSE DESCRIPTION:

This course introduces the fundamental concepts of data communication and computer networks. Students will explore the underlying principles of data transmission, network protocols, network architectures, and various network devices. The course emphasizes understanding the technologies that enable communication between computers and devices across a network.

COURSE OBJECTIVE (S):

The objectives of this course are to:

- Explain the fundamental concepts of data communication and networking.
- Analyze the different network models (OSI and TCP/IP) and identify various network devices and their functionalities.
- Understand the operation of data link layer protocols and Explain network layer routing algorithms and protocols.
- Describe transport layer protocols and services and Analyze application layer protocols and their applications.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental concepts of data communication, network models, and network protocols.	1,2 and 9	1,2,3
CO2	Analyze the functionalities of various network devices and their role in data communication.	1,2 and 10	1,2,3
CO3	Describe the operation of data link layer protocols like error detection and correction techniques.	1,2 and 9	1,2,3
CO4	Explain network layer routing algorithms and protocols (e.g., static routing, dynamic routing).	1,2 and 9	1,2,3
CO5	Describe transport layer protocols (TCP, UDP) and their services and Analyze application layer protocols and their applications.	1,2 and 9	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2				✓		
CO3		✓				
CO4		✓				
CO5		✓		✓		

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3							3				3	1	1
CO2	2	2								2			3	1	1
CO3	2	2							2				1	3	1
CO4	2	2							2				3	1	2
CO5	2	2							2				2	1	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT :

Content

Introduction to Data Communication and Networks: Basic Concepts: Define Data Communication, Networks, and Network Components (nodes, links, devices), Advantages of using Computer Networks (resource sharing, communication, cost savings), Different Network Types (LAN, WAN, MAN, PAN). Data and Signals, Digital Signals, Transmission Impairment.

Network Models (OSI and TCP/IP): TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.

Physical Layer and Data Link Layer: Transmission Media (twisted pair, coaxial cable, fiber optics), Different Transmission Techniques (analog vs. digital, baseband vs. broadband), Multiplexing and Spread Spectrum Nodes and Links, Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking.

Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Packet Switching, IPV4 Addresses: Classful Addressing, Classless Addressing, Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. Routing Algorithms: Distance Vector Routing, Link State Routing.

Transport Layer and Application Layer: User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, TCP congestion Control. Standard Client -Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection.

Self-Learning Component:

1. Website Link "https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm"
2. Network Management Tools like GNS3, Cisco Packet Tracer

TEXT BOOKS:

1. "Computer Networks" by Andrew S. Tanenbaum
2. "Data Communications and Networking" by Behrouz A. Forouzan
3. "Data and Computer Communication" by William Stallings

REFERENCE BOOKS:

1. "Computer Networking: A Top-Down Approach" by James F. Kurose & Keith W. Ross
2. James J Kurose, Keith W Ross, " Computer Networks", Pearson Education.

3. Wayne Tomasi, "Introduction to Data Communication and Networking'', Pearson Education.

JOURNALS/MAGAZINES:

1. https://www.comsoc.org/publications/journals/ieee-tcom
2. https://link.springer.com/journal/10922
3. https://www.officialmediaguide.com/ie31/commmag/

SWAYAM NPTEL/MOOCs

1. Fundamentals of Network Communication by University of Colorado System (https://www.coursera.org/learn/fundamentals-network-communications)
2. Introduction to TCP/IP (https://www.coursera.org/learn/tcpip)
3. Communication Networks (https://onlinecourses.nptel.ac.in/noc24_ee71/preview)

Course Title	Cryptography and Network Security Lab				Course Type		HC	
Course Code	B24EF0605	Credits	1		Class		VI semester	
Course	LTP		Contact	Work	Total Number of Classes		Assessment weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	1	2	2	-	28	25	25

COURSE DESCRIPTION:

This laboratory course supplements the material taught in the theory course Cryptography and Network Security. The objective of this lab is to get hands-on experience in Computer Networks, Cryptography and Network Security concepts using simulation tools Viz.Wireshark, Nmap, SNIFF, SNORT, JCRYPT, etc. Laboratory exercises will normally be conducted on UNIX Operating system. The students will be exposed to simulating and analyzing concepts.

COURSE OBJECTIVE (S):

The objective of this course is to:

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

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the cryptographic algorithms for data communication.	1- 4 ,9-12	1,2,3
CO2	Compare the performance of various security algorithms.	1-4,6,9-12	1,2
CO3	Apply the Digital signature for secure data transmission.	1-6,	1,2,3
CO4	Calculate the message digest of a text using the SHA-1algorithm.	1-6	1,2,3
CO5	Utilize the different open source tools for network security and analysis.	1-6,	1,2,3
CO6	Demonstrate intrusion detection system using network security tool.	1-6	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			✓			
CO2				✓		
CO3			✓			
CO4				✓		
CO5			✓			
CO6				✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2		2	2	2		3	3		
CO2	3	3	3	3	2	3		2	2	2		3		3	
CO3	3	3	3	3	2	3		3	2	2		3		3	3
CO4	3	3	2	3	3	3		3	3	2		3		3	3
CO5	3	3	2	1	3	3		2	2	1		3	3	3	
CO6	3	3	3	3	2	3		2	2	2		3		3	3

Note: 1-Low, 2-Medium, 3-High

PRACTICE:

Part A			
Sl No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	Write a Java program to perform encryption and decryption using the following algorithms a) Ceaser Cipher b) Substitution Cipher c)Hill Cipher	Tools: JDK, IDE like IntelliJ IDEA, Eclipse, or NetBeans, HTML and JavaScript for web-based and implementations, Cryptography libraries (e.g., javax.crypto, java.security) Technics: Understanding of basic cryptographic concepts and algorithms, Key generation and management, Encryption and decryption processes, Hashing techniques and integrity checks -Short these points.	Java programming, ⍰ Caesar Cipher, Substitution Cipher, Hill Cipher, DES, RSA) ⍰ Understanding of Diffie-Hellman Key Exchange,HTML, JavaScript,
2	Write a program to implement the DES algorithm logic		
3	Write a program to implement RSA Algorithm		
4	Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).		
5	Calculate the message digest of a text using the SHA-1 Algorithm.		
Part B			
6	Performa an experiment to demonstrate how to Sniff for Router traffic by using the tool Wireshark.	Wireshark, Aircrack-ng, Ettercap, Jcrypt, Snort. Techniques: Packet Sniffing, Wireless Auditing ,ARP Poisoning, Cryptographic Operations and Intrusion Detection.	Proficiency with Network Analysis Tools, Understanding of Wireless Security, Cryptography Knowledge, IDS Configuration and Monitoring, Basic Command Line Skills.
7	Perform a Wireless Audit of an Access Point / Router and Decrypt Wep and Wpa.		
8	Perform an experiment to Sniff Traffic using Arp Poisoning.		
9	Install Jcrypt Tool (Or Any Other Equivalent) and demonstrate Asymmetric, Symmetric Crypto Algorithm, Hash and Digital/Pki Signatures.		
10	Demonstrate Intrusion Detection System (Ids) using any tool. Eg. Snort or any other S/W.		

NOTE: A STUDENT MUST EXECUTE ONE EXPERIMENT FROM EACH PART IN THE EXAM.

ADDITIONAL EXPERIMENTS:

1. Write a program to implement the BlowFish algorithm logic
2. Write a program to implement the Rijndael algorithm logic.
3. Calculate the message digest of a text using the MD5 algorithm.
4. Perform an experiment to grab a banner with Telnet and perform the task using Netcat Utility.
5. Perform an experiment for Port Scanning with Nmap, Superscan or any other Software.
6. Using Nmap 1) Find Open Ports on a System 2) Find the machines which are Active 3) Find The version of Remote OS on other Systems 4) Find the version of S/W installed on other System.
7. Perform an experiment on Active and Passive Fingerprinting using Xprobe2 and Nmap.

<table>
<tr><td>Course Title</td><td colspan="4">Blockchain Technology lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0603</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact</td><td>Work</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

The Blockchain Technology Laboratory is a practical, hands-on course that complements the theoretical understanding of blockchain technology. In this laboratory, students will gain practical experience in working with blockchain platforms, tools, and applications. Through a series of guided exercises, projects, and real-world simulations, students will learn how to design, develop, and deploy blockchain solutions.

COURSE OBJECTIVES:

The objectives of this course are to

1. Provide students with practical experience in implementing blockchain solutions.
2. Gain proficiency in working with various blockchain platforms, such as Ethereum, Hyperledger Fabric, and others.
3. Learn the basics of smart contract programming languages, such as Solidity (for Ethereum) and Chaincode (for Hyperledger Fabric).
4. Focus on the development of decentralized applications (dApps) that interact with blockchain networks.
5. Illustrate various real-world use cases where blockchain technology can be applied, such as supply chain tracking, decentralized finance (DeFi) applications, and identity management.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Design, code, and deploy smart contracts using languages like Solidity (for Ethereum) or Chaincode (for Hyperledger Fabric).	1,2,3	1,2
CO2	Build decentralized applications that interact with blockchain networks.	1,2,3	1,2
CO3	Know how to implement security best practices and conduct testing to ensure the reliability of their blockchain applications.	1,2,3,5	2,3
CO4	Develop projects based on selected use cases and demonstrate their practical implementation.	3,4,9,10,11	1,2,3
CO5	Apply blockchain concepts and tools to real-world problems and devise innovative solutions using blockchain technology.	1,2,3	1,2,3
CO6	Demonstrate critical thinking skills in evaluating blockchain solutions, identifying strengths and weaknesses, and adapting their approaches to different use cases.	1,2,3,4,9,10,11	1,2,3

BLOOM’S LEVELOF THECOURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1		√				
CO2		√				
CO3			√			
CO4			√	√		
CO5		√		√		
CO6			√	√		

COURSE ARTICULATIONMATRIX

Course Outcomes	**Program Outcomes**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	**3**	**2**	**1**										**3**	**2**	
CO 2	**2**	**3**	**1**										**2**	**3**	
CO 3	**2**	**3**	**3**		**3**									**2**	**3**
CO 4			**3**	**3**					**2**	**2**	**3**		**1**	**3**	**2**
CO 5	**2**	**3**	**3**										**2**	**3**	**1**
CO 6	**1**	**3**	**2**	**3**					**2**	**2**	**2**		**1**	**3**	**2**

Note: 1-Low, 2-Medium, 3-High

Sl No.	Title of the Experiment
1.	**Experiment 1: Perform the following to understand the basics of blockchain.** ▪ Send a Message Using Symmetric Cryptography ▪ Sign a Message Using Asymmetric Cryptography ▪ Generate Hash Using Hash function ▪ Generate a Nonce Value ▪ Working on Distributed Ledger ▪ Working on Blockchain Transaction ▪ Create Blockchain Network
2.	**Experiment 2: Perform the following to understand Bitcoin blockchain.** ▪ Install a Software Wallet (combine software and web wallet) ▪ Generate a Web Wallet ▪ Review and Analyze a Bitcoin Block on Explorer ▪ Analyze a Bitcoin Transaction
3.	**Experiment 3: Perform the following to understand Ethereum blockchain.** ▪ Exploring the Ethereum Mainnet ▪ Explore an Ethereum Test Network ▪ Install the Ganache Blockchain ▪ Explore the Ganache Blockchain ▪ Install MetaMask and Set up the Wallet ▪ Connect MetaMask to a Ganache Test Network ▪ Install Geth Client ▪ Set up a Private Blockchain node Network using geth
4.	**Experiment 4: Perform the following to understand Enterprise blockchain.** ▪ Setup Hyperledger Fabric Prerequisite ▪ Setup Hyperledger Fabric ▪ Start and stop test network ▪ Explorer ▪ Create Node Js Application ▪ Create a Web Application using the Express Js file approach ▪ Create Web Application using Express Js Node Project Approach
5.	**Experiment 5: Perform the following to understand Ethereum Smart Contracts** ▪ Generate the ABI and Bytecode of a Smart Contract ▪ Deploy a Smart Contract to Ganache Network ▪ Develop a Smart contract that stores ethers and transfers to a personal account ▪ Price Event Smart Contract ▪ Develop a Property Transfer Smart Contract using Remix IDE ▪ Create a Custom Token and Deploy it on Ropsten Network ▪ Truffle Setup and create a project ▪ Truffle Create Marketplace contract ▪ Compile Marketplace contract ▪ Deploy Marketplace contract ▪ Access Smart Contracts Functions from the Frontend
6.	**Experiment 6: Perform the following to understand Hyperledger Fabric chaincode**

	▪ Create New Gradle Project for Car Showroom ▪ Create Chaincode for Car Showroom ▪ Package the Chaincode ▪ Install the Chaincode ▪ Approve the Chaincode ▪ Commit the Chaincode ▪ Access Chaincode Functions ▪ Chaincode Lifecycle steps from a shell file
7.	**Experiment 7: Perform the following to understand Hyperledger Fabric SDK** ▪ Enroll Admin User ▪ Register and Enroll Client User ▪ Access Chaincode Functions ▪ Create Node Project and add dependencies ▪ Enroll admin user to the network ▪ Enroll register and enroll client users to the network ▪ Access Chaincode Functions using Rest API
8.	**Experiment 8:** Use IBM Blockchain Platform to develop and deploy smart contracts on a Hyperledger Fabric network. Create and execute transactions on the network to interact with the smart contracts.

TEXTBOOKS:

a. Aravind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder," Bitcoin and Cryptocurrency Technologies-a Comprehensive Introduction", Princeton University Press,2016.

REFERENCE BOOKS:

1. Martin Quest, "Crypto Master Set", 2018.
2. Antony Lewis, "The Basics of Bitcoins and Blockchains-An Introduction to Cryptocurrencies and the Technology that powers them", Mango Publishing, 2018.
3. Nitin Gaur, Luc Desrosiers, Venkatraman Ramakrishna, Petr Novotny, Dr. Salman A. Baset Anthony O'Dowd, "Hands-On Blockchain with Hyperledger-Building decentralized applications with Hyperledger Fabric and Composer", Pact Publishing,2018.
4. Andreas M. Antonopoulos, Dr. Gavin Wood, "Mastering Ethereum -Building Smart Contracts and dApps", Ethereum Book LLC,2019.
5. Rui Zhang, Rui Xue, and Ling Liu. 2019. Security and Privacy on Blockchain. ACMComput. Surv. 1, 1, Article 1 (January 2019), 35 pages. https://doi.org/10.1145/3316481

JOURNALS/MAGAZINES:

1. https://soliditylang.org/
2. https://hyperledger-fabric.readthedocs.io/en/release-2.5/
3. https://remix.run/docs/en/main

https://remix-ide.readthedocs.io/en/latest/

<table>
<tr><td>Course Title</td><td colspan="4">Machine Learning and Applications Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0604</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Workload</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>0</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW:

This course provides an in-depth exploration of various machine learning algorithms and techniques through hands-on Python programming. Students will learn to implement linear regression, Naive Bayes, Support Vector Machines (SVM), K-nearest neighbors (KNN), decision trees (ID3), random forests, K-means clustering, multilayer perceptrons (MLP), and artificial neural networks (ANN). Emphasis will be placed on understanding the theoretical foundations, practical implementation, data preprocessing, visualization, and accuracy assessment for each algorithm.

COURSE OBJECTIVE (S):

The objective of this course is to:

- To understand the theoretical concepts underlying a variety of machine learning algorithms.
- To gain proficiency in implementing machine learning algorithms using Python programming.
- To develop skills in preprocessing, visualizing, and analyzing datasets for machine learning tasks.
- To evaluate and compare the performance of different machine learning algorithms on real-world datasets.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop proficiency in linear regression, multiple linear regression, and Naive Bayes classification techniques across diverse datasets. Apply rigorous data preprocessing, visualization, and accuracy assessment methods.	1 to 5,8,9,10,12	1,2,3
CO2	Master Support Vector Machines (SVM), K-nearest Neighbors (KNN), and decision trees (ID3) for classification tasks. Perform thorough data preprocessing, visualize decision boundaries, clusters, and tree structures, and critically evaluate model performance.	1 to 5,8,9,10,12	1,2,3
CO3	Explore ensemble learning techniques such as random forests and multilayer perceptrons (MLP) for improved model accuracy. Emphasize feature importance visualization, network architecture understanding, and interpretability.	1 to 5,8,9,10,12	1,2,3
C04	Gain competence in unsupervised learning through K-means clustering. Conduct comprehensive data preprocessing, visualize clusters, and evaluate clustering quality metrics.	1 to 5,8,9,10,12	1,2,3
CO5	Implement artificial neural networks (ANN) for complex Cancer datasets, demonstrating adeptness in extensive data preprocessing, network architecture visualization, and rigorous accuracy evaluation.	1 to 5,8,9,10,12	1,2,3
CO6	Synthesize findings from all experiments, critically evaluate the performance of various machine learning algorithms, and propose informed recommendations based on experimental outcomes.	1 to 5,8,9,10,12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		✓	✓	✓	✓	
CO2		✓	✓	✓	✓	
CO3		✓	✓	✓	✓	
C04		✓	✓	✓	✓	
CO5		✓	✓	✓	✓	
CO6		✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	2			3	2	2	1	2	2	1	2
CO2	1	2	2	1	2			3	2	2	1	2	2	1	2
CO3	1	2	2	1	2			3	2	2	1	2	2	1	2
CO4	1	2	2	1	2			3	2	2	1	2	2	1	2
CO5	1	2	2	1	2			3	2	2	1	2	2	1	2
CO6	1	2	2	1	2			3	2	2	1	2	2	1	2

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Write a Python program to program on linear and multiple linear regression using ML for the education dataset do the necessary pre-processing, data visualization and calculate accuracy.	Python, Jupyter Notebook	Programming Skills
2	Write a Python program to implement the SVM algorithm for the credit card dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
3	Write a Python program to implement KNN algorithm for the diabetes dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
4	Write a Python program to implement the Navie Bayes algorithm for the Sensex dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
5.	Write a Python program to implement the decision tree-ID3 algorithm for the employee dataset, along with the required data preprocessing, data visualization, and accuracy calculations	Python, Jupyter Notebook	Programming Skills
6	Write a Python program to implement the random forest algorithm for the IPL dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills

7	Write a Python program to implement the K-means clustering for the Olympic 2020 dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
8	Write a Python program to implement the HMM algorithm for the house rental dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
9	Write a Python program to implement the multilayer perceptron algorithm for the types of vehicle dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills
10	Write a Python program to implement the ANN algorithm for the Cancer dataset, along with the required data preprocessing, data visualization, and accuracy calculations.	Python, Jupyter Notebook	Programming Skills

Project

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	**Education Dataset - Linear and Multiple Linear Regression**: • Description: Predict student performance using linear and multiple linear regression on the education dataset. • Tasks: ○ Load and preprocess the education dataset (handle missing values, encode categorical variables). ○ Implement linear and multiple linear regression models using scikit-learn. ○ Visualize relationships between predictors and student performance. ○ Calculate accuracy metrics such as mean squared error or R-squared.	Python, Jupyter Notebook	Programming Skills
2	**Credit Card Dataset - Support Vector Machine (SVM)**: • Description: Detect credit card fraud using the SVM algorithm on the credit card dataset. • Tasks: ○ Load and preprocess the credit card dataset (handle imbalance, normalize features). ○ Implement SVM using scikit-learn. ○ Visualize decision boundaries and support vectors. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.	Python, Jupyter Notebook	Programming Skills
3	**Diabetes Dataset - K-nearest Neighbors (KNN)**: • Description: Predict diabetes using the KNN algorithm on the diabetes dataset. • Tasks: ○ Load and preprocess the diabetes dataset (scale features, handle missing values). ○ Implement KNN using scikit-learn. ○ Visualize clusters and decision boundaries. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.	Python, Jupyter Notebook	Programming Skills
4	**Sensex Dataset - Naive Bayes**: • Description: Predict stock market trends using the Naive Bayes algorithm on the Sensex dataset.	Python, Jupyter Notebook	Programming Skills

	• Tasks: ○ Load and preprocess the Sensex dataset (handle missing values, encode categorical variables). ○ Implement Naive Bayes using scikit-learn. ○ Visualize feature distributions. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.		
5.	**Employee Dataset - Decision Tree (ID3)**: • Description: Predict employee attrition using the ID3 algorithm on the employee dataset. • Tasks: ○ Load and preprocess the employee dataset (handle missing values, encode categorical variables). ○ Implement ID3 decision tree algorithm. ○ Visualize the decision tree structure. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.	Python, Jupyter Notebook	Programming Skills
6	**IPL Dataset - Random Forest**: • Description: Predict IPL match outcomes using the Random Forest algorithm on the IPL dataset. • Tasks: ○ Load and preprocess the IPL dataset (handle missing values, encode categorical variables). ○ Implement Random Forest using scikit-learn. ○ Visualize feature importances. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.	Python, Jupyter Notebook	Programming Skills
7	**Olympic 2020 Dataset - K-means Clustering**: • Description: Cluster Olympic athletes based on performance using the K-means algorithm on the Olympic 2020 dataset. • Tasks: ○ Load and preprocess the Olympic 2020 dataset (handle missing values, scale features). ○ Implement K-means clustering using scikit-learn. ○ Visualize clusters. ○ Calculate clustering evaluation metrics such as silhouette score or inertia.	Python, Jupyter Notebook	Programming Skills
8	**House Rental Dataset - Hidden Markov Model (HMM)**: • Description: Predict house rental prices using the Hidden Markov Model algorithm on the house rental dataset. • Tasks: ○ Load and preprocess the house rental dataset (handle missing values, encode categorical variables). ○ Implement HMM using libraries like hmmlearn. ○ Visualize the model's states and transitions. ○ Calculate accuracy metrics such as mean absolute error or root mean squared error.	Python, Jupyter Notebook	Programming Skills
9	**Types of Vehicle Dataset - Multilayer Perceptron (MLP)**: • Description: Classify types of vehicles using a multilayer perceptron neural network on the types of vehicle dataset. • Tasks: ○ Load and preprocess the types of vehicle dataset (scale features, split into training and testing sets). ○ Implement MLP using libraries like TensorFlow or Keras.	Python, Jupyter Notebook	Programming Skills

	○ Visualize the model's architecture. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.		
10	**Cancer Dataset - Artificial Neural Network (ANN)**: • Description: Diagnose cancer using an artificial neural network on the Cancer dataset. • Tasks: ○ Load and preprocess the Cancer dataset (handle missing values, encode categorical variables). ○ Implement ANN using libraries like TensorFlow or Keras. ○ Visualize the model's architecture. ○ Calculate accuracy metrics such as accuracy, precision, recall, and F1-score.	Python, Jupyter Notebook	Programming Skills

Textbooks:

1."Introduction to Machine Learning" by Ethem Alpaydin, 3rd Edition, published by The MIT Press in 2014.
2."Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, 2nd Edition, published by O'Reilly Media in 2019.
3."Pattern Recognition and Machine Learning" by Christopher M. Bishop, 1st Edition, published by Springer in 2006.
4."Python for Data Analysis" by Wes McKinney, 2nd Edition, published by O'Reilly Media in 2017.

Reference Books:

1."Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy, 1st Edition, published by The MIT Press in 2012.
2."Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 1st Edition, published by The MIT Press in 2016.
3."The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, 2nd Edition, published by Springer in 2009.
4."Python Data Science Handbook" by Jake VanderPlas, 1st Edition, published by O'Reilly Media in 2016.

Journals/Magazines:

1."IEEE Transactions on Pattern Analysis and Machine Intelligence" - Published by IEEE Computer Society.
2."Journal of Machine Learning Research" - Published by JMLR.
3."Data Mining and Knowledge Discovery" - Published by Springer.
4."Neural Networks" - Published by Elsevier.
5."International Journal of Computer Vision" - Published by Springer.
6."Journal of Artificial Intelligence Research" - Published by AI Access Foundation.

SWAYAM NPTEL/MOOCs

1. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
2.NPTEL course: "Machine Learning for Engineering and Science Applications" - This course covers basics to advanced concepts in machine learning with practical applications.
3.Coursera course: "Machine Learning" by Andrew Ng - An introductory course covering the fundamentals of machine learning algorithms and their applications.

Course Title	Mini Project				Course Type		HC	
Course Code	B24EI0605	Credits	2		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	2	4	4				
	Total	**2**	**4**	**4**	**-**	**56**	**50**	**50**

COURSE OVERVIEW

The course overview is designed to guide participants through the comprehensive landscape of project management, focusing on developing the necessary skills and knowledge to effectively manage complex projects. The curriculum emphasizes practical application, sustainable development, and ethical responsibilities in project execution.

COURSE OBJECTIVES

The objectives of this course are to

1. Demonstrate comprehensive understanding and expertise in the selected project topic, ensuring a solid foundation for further exploration and application.
2. Identify, analyze, and articulate complex problems relevant to the project, formulating substantiated conclusions that guide the development of effective solutions.
3. Design innovative and practical solutions tailored to the identified project problem, incorporating theoretical and empirical insights.
4. Undertake thorough investigations into the project problem, employing appropriate methodologies to derive valid conclusions and insights.
5. Utilize modern engineering techniques, resources, and tools effectively throughout the project lifecycle to enhance project outcomes.
6. Apply project results in a manner that promotes sustainable development, considering social, economic, and environmental impacts.
7. Understand and evaluate the implications of project outcomes in the context of environmental sustainability, ensuring responsible project execution.
8. Recognize and uphold professional and ethical responsibilities during project execution, fostering integrity and accountability.
9. Function effectively both as an individual contributor and as a collaborative team member, enhancing project dynamics and outcomes.
10. Develop and refine oral and written communication skills for effective presentation and reporting of project findings.
11. Demonstrate knowledge and understanding of cost estimation and time management techniques necessary for successful project execution.
12. Engage in continuous learning and professional development to enhance knowledge and competencies in the chosen project area, adapting to evolving industry standards and practices.

COURSE OUTCOMES (CO’S):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low, 2-Medium, 3-High

The students are informed to follow the following instructions to complete the Skill development-2: Students will be offered training and certifications on the trending technologies from the industry experts.The students are evaluated and certified after the training programs.

<table>
<tr><td>Course Title</td><td colspan="4">AEC-4 (Ability Enhancement Course - Placement Training)</td><td colspan="2">Course Type</td><td colspan="2">AEC</td></tr>
<tr><td>Course Code</td><td>B24EF0609</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course
Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>25</td><td>25</td></tr>
</table>

COURSE OVERVIEW

Placement training classes can effectively be conducted as a part of an Ability Enhancement Course (AEC). These courses are designed to enhance students' skills, making them more prepared and competitive for the job market.

VII SEMESTER

VII Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/SC/OE/MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EI0701	Cyber Forensics and Investigation	HC	3	0	0	3	3	50	50	100	PCC
2	B24EIS71X	Professional Elective-6	SC	3	0	0	3	3	50	50	100	PEC
3	B24EI0702	Capstone Project Phase-1	HC	0	0	2	2	4	50	50	100	Proj
4	B24EI0703	Internship/Global Certification	HC	0	0	2	2	4	50	50	100	Intern
TOTAL				**6**	**0**	**4**	**10**	**14**	**200**	**200**	**400**	
TOTAL SEMESTER CREDITS					**10**							
TOTAL CUMULATIVE CREDITS					**146**							
TOTAL CONTACT HOURS					**14**							
TOTAL MARKS					**400**							

<table>
<tr><td>Course Title</td><td colspan="4">Cyber Forensics and Investigation</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0701</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VII semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td>Theory</td><td>Practical</td><td>CIE</td><td>SEE</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course provides an in-depth understanding of cyber forensics and investigation techniques used to combat cybercrime. It covers the legal, ethical, and procedural aspects of digital forensics, along with practical skills in identifying, collecting, analyzing, and presenting digital evidence.

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Understand the principles of cyber forensics and its role in the investigation of cybercrimes.
2. Learn the legal and ethical considerations in digital forensics.
3. Acquire skills in the tools and techniques used for forensic analysis of digital evidence.
4. Develop the ability to investigate various types of cybercrimes.
5. Gain practical experience in conducting forensic investigations.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	To use a variety of digital forensics tools and techniques to identify, collect, analyze, and preserve digital evidence.	1,2,3,4,5,6	1,2,3
CO2	Develop a thorough understanding of the legal and ethical considerations in cyber forensics.	1,2,3,4,5,6	1,2,3
CO3	Implement effective incident response strategies, including the preparation, detection, analysis, containment, eradication, and recovery phases.	1,2,3,4,5,6	1,2,3
CO4	Gain the capability to conduct forensic investigations across various digital environments, including computer systems, networks, mobile devices, cloud services, and social media platforms.	1,2,3,4,5,6	1,2,3
CO5	Enhance their analytical and critical thinking skills, enabling them to piece together complex digital evidence and uncover patterns, anomalies, and indicators of compromise.	1,2,3,4,5,6	1,2,3
CO6	Learn to document and communicate their findings clearly and effectively.	1,2,3,4,5,6	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3			√			
CO4		√				
CO5		√				
CO6		√				

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3
CO2	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3
CO3	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3
CO4	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3
CO5	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3
CO6	3	3	3	3	3	1	-	-	-	-	-	1	3	2	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Cyber Forensics: **Definition and Scope,** What is cyber forensics?, Importance and scope in the digital age, **History and Evolution:**Development of digital forensics., Key milestones and case studies, **Types of Cyber Crimes** Common cybercrimes (hacking, phishing, identity theft, etc.). Emerging trends and threats.

Legal and Ethical Considerations: Cyber Laws and Regulations, Overview of relevant laws (e.g., Computer Fraud and Abuse Act, GDPR), International legal frameworks. Ethical Issues in Cyber Forensics, Ethical dilemmas and best practices. Privacy concerns and data protection, Chain of Custody,Importance of maintaining a proper chain of custody, Documentation and procedures.

Digital Evidence: Types of Digital Evidence, Sources of digital evidence (computers, mobile devices, networks), Volatile vs. non-volatile evidence, Collection and Preservation, Techniques for collecting digital evidence, Ensuring integrity and authenticity, Tools for Digital Evidence Collection, Overview of popular forensic tools (e.g., EnCase, FTK, Autopsy).

Computer Forensics: Forensic Imaging and Acquisition, Creating forensic images, Best practices for acquisition, File Systems and Data Recovery, Understanding different file systems (NTFS, FAT, etc.), Techniques for data recovery and analysis, Windows Forensics, Investigating Windows systems, Registry analysis, event logs, and artifacts.

Network Forensics: Network Evidence Collection, Tools and techniques for capturing network traffic, Analyzing network packets and logs, Intrusion Detection and Analysis, Identifying and analyzing network intrusions, Using IDS/IPS systems, Wi-Fi and Wireless Forensics, Investigating wireless networks, Tools and techniques for Wi-Fi forensics.

Mobile Device Forensics: Mobile Device Evidence, Types of evidence from mobile devices, Challenges in mobile forensics, Tools and Techniques, Tools for mobile device forensics (e.g., Cellebrite, Oxygen Forensic Suite), Techniques for extracting and analyzing data from iOS and Android devices, App Analysis, Analyzing data from mobile apps, Recovering deleted data.

Internet and Email Forensics: Web Browser Forensics, Investigating web browser activities, Analyzing cache, cookies, and history, Email Forensics, Techniques for email investigation, Analyzing email headers and attachments, Social Media Forensics, Investigating social media accounts and activities, Challenges and techniques for social media forensics.

Cloud Forensics: Cloud Computing Fundamentals, Basics of cloud computing and cloud services, Challenges in Cloud Forensics, Legal and technical challenges, Data acquisition in cloud environments, Forensic Tools and Techniques, Tools for cloud forensics, Best practices for investigating cloud-based data.

Incident Response and Handling: **Incident Response Process,** Steps in the incident response lifecycle, **Forensic Readiness,** Preparing for forensic investigations, Developing a forensic readiness plan, **Case Studies,** Analysis of real-world incidents and responses.

Reporting and Presentation: Documentation and Reporting, Creating comprehensive forensic reports, Best practices for documentation, Presenting Evidence in Court, Legal considerations for presenting digital evidence, Effective presentation techniques, Expert Witness Testimony, Role of a forensic expert witness, Preparing for testimony.

Self Learning Component:

Virtual labs where students can practice forensic techniques. Platforms like Cyber Aces, TryHackMe, or Hack The Box can be used for hands-on exercises in areas like disk imaging, malware analysis, and network packet inspection.

TEXT BOOKS:

1. Volonino, L., Anzaldua, R., & Godwin, J. (2006). *Computer Forensics: Principles and Practices (Prentice Hall Security Series)*. Prentice-Hall, Inc.
2. Johansen, G. (2017). *Digital forensics and incident response*. Packt Publishing Ltd.

REFERENCE BOOKS:

1. Nelson, B., Phillips, A., & Steuart, C. (2010). *Guide to computer forensics and investigations* (p. 720). Course Technology Cengage Learning.
2. Marcella Jr, A., & Menendez, D. (2010). *Cyber forensics: a field manual for collecting, examining, and preserving evidence of computer crimes*. Auerbach Publications.

JOURNALS/MAGAZINES:

1. **Forensic Science International: Digital Investigation**
2. **International Journal of Cyber Forensics and Advanced Threat Investigations**
3. **NFSU JOURNAL OF CYBER SECURITY AND DIGITAL FORENSICS**
4. **Digital Investigation: The International Journal of Digital Forensics & Incident Response**

SWAYAMNPTEL/MOOCs

1. **https://onlinecourses.swayam2.ac.in/cec21_ge10/preview**
2. **https://onlinecourses.swayam2.ac.in/cec20_lb06/preview**
3. **https://onlinecourses.nptel.ac.in/noc23_cs127/preview**

Professional Electives - VI

Course Title	Industrial IoT				Course Type		SC	
Course Code	B24EIS711	Credits	3		Class		VII	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	3	3	3	42	-	50	50

COURSE OVERVIEW:

IoT has an enormous market potential of billions of connected devices generating Trillions in revenues. IoT will change industries and transform the way we work and live. Industrial companies are already pivoting from Products to Services leveraging IoT technologies – this digital transformation is more broadly called the Industrial IoT or Industrial Internet. In the end, these industrial companies will become network-based businesses with connected products and factories. It's imperative that these companies transform their organizational architecture as they become connected network businesses

COURSE OBJECTIVE (S):

The objective of this course is to:

1. Students will learn the new evolution in hardware, software, and data.
2. Understand good depth of knowledge of Designing Industrial IOT Systems for various application
3. Provide many new Industrial Internet of Things (IIoT) prospects
4. Presents significant challenges ranging from technology architectural choices to security concerns.
5. Students acquire upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify sensors, localization, wireless protocols, data storage and security aspects	2, 3	1
CO2	Exhibit good depth of knowledge of Designing Industrial IoT Systems for various application.	1, 2, 3	2
CO3	Customize the design and analysis of Industry 4.0 Systems suitable to modern engineering field	2, 3	3
CO4	Explore the Predictive Maintenance with IIoT technology	2, 3	3
CO5	Show case the knowledge of key IIoT concepts including IoT technologies and Architectures.	2, 3	3
CO6	Apply his knowledge to develop and implement own IoT technologies, solutions, applications and regulations	2, 3	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Under Stand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√			
CO3			√	√		√
CO4			√	√	√	
CO5		√				
CO6			√			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2								2	3	1	1
CO2	2	3	2	1	2							2	3	2	2
CO3	2	3	3	2	2								3	3	3
CO4	3	3	3	2	2								3	3	3
CO5	2	3	2	2	2								3	3	3
CO6	3	3	2	2								2	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Introduction to Industrial IoT (IIoT) Systems:

The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

Implementation systems for IIoT:

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

IIoT Data Monitoring & Control:

IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology,

Case Studies of IIoT Systems:

IIoT application development with Embedded PC based development boards, Development of mini Project on new version of Operating systems and Edge development board. That project should also address to the current societal needs.

Self-Learning Component:

Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management

TEXT BOOKS:

1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress, 2016
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science, 2017

REFERENCE BOOKS:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

4. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers

JOURNALS/MAGAZINES:

1.IEEE Internet of Things Magazine
2.IEEE Transactions on Industrial Electronics
3.IEEE Transactions on Dependable and Secure Computing
4.Internet of Things; Engineering Cyber-Physical Human Systems
5.Journal of Network and Systems Management - Springer | 2021 Impact Factor:2.198|Cite Score:4.5|Q2
6.Wireless Communications and Mobile Computing Journal - Hindawi | 2021 Impact Factor:0.648|Cite Score:3.5|Q2
7.Journal of Ambient Intelligence and Smart Environments - IOS Press | 2021 Impact Factor:2.105|Cite Score:4.3|Q2
8.Wireless Personal Communications Journal - Springer Nature | 2021 Impact Factor:2.017|Cite Score:3.5|Q3

SWAYAMNPTEL/MOOCs

1. Introduction to Industry 4.0 and Industrial Internet of Things, NPTEL SWAYAM, https://onlinecourses.nptel.ac.in/noc20_cs69/preview.
2. Introduction to Industry 4.0, NPTEL, https://archive.nptel.ac.in › courses

Course Title	**Blockchain Tools and Application**				**Course Type**		**SC**	
Course Code	**B24EIS712**	**Credits**	**3**		**Class**		**VII Semester**	
	LTP	**Credits**	**Contact Hours**	**Workload**	**Total Number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**				
	Practice	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	**42**		**50**	**50**

COURSE OVERVIEW:

This course offers an in-depth exploration of blockchain technology, focusing on prominent blockchain platforms Ethereum and Hyperledger. Students will delve into the frameworks and implementation strategies of these platforms, gaining practical experience by creating, deploying, and interacting with smart contracts. These smart contracts are the foundation of decentralized applications (DApps), and the course will cover the principles behind their design and development. Students will learn to set up their blockchain development environment, write smart contracts using languages like Solidity, and interact with blockchain networks using specialized libraries. The curriculum includes real-world applications and case studies, providing insights into blockchain's utilization in industries such as automotive and finance.

Advanced topics include the Interplanetary File System (IPFS), Zero-Knowledge Proofs, blockchain's integration with IoT, and quantum computing. The course also explores blockchain's intersection with emerging technologies like self-sovereign identity and blockchain cloud offerings. By the end of the course, students will be proficient in smart contract development, understand advanced blockchain concepts, and envision the future potential of blockchain across various industries.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. To provide hands-on skills in writing smart contracts using programming languages like Solidity.
2. To analyze the various practical blockchain platforms and frameworks, such as Ethereum and Hyperledger.
3. To develop and build decentralized applications (DApps).
4. To investigate advanced topics like the Interplanetary File System (IPFS), Zero-Knowledge Proofs, and the integration of blockchain with IoT and quantum computing.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Familiar with the various tools and platforms used to build, deploy, and interact with blockchain networks.	1,2,3,4,5	1,2
CO2	Design and implement smart contracts using a programming language specific to the chosen blockchain platform.	1,2,3,4,5	1,2
CO3	Develop an application using Ethereum and solidity.	1,2,3,4,5,6	1,2,3
CO4	Develop an application using Hyperledger.	1,2,3,4,5,6	1,2,3
CO5	Make use of different blockchain platforms in real world application.	1,2,3,4,5,6,7	1,2,3
CO6	Evaluate existing systems and identify opportunities for integrating blockchain technology into those systems.	1,2,3,4,5,6,7	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√	√			
CO3			√	√		
CO4			√	√		
CO5		√	√	√		
CO6			√	√	√	

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2								3	2	
CO2	2	3	2	2	2								2	3	
CO3	2	3	3	2	3	2							2	2	2
CO4	2	3	3	2	3	2							2	2	2
CO5	2	3	3	2	2	2	2						2	2	2
CO6	2	2	2	3	2	2	2						2	2	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Smart Contracts: Life cycle of a smart contract, Introduction to Ethereum High Level language, Building a smart contract with Solidity, The Ethereum Contract ABI, **Programming with Solidity:** Data Types, Predefined Global Variables and Functions, Contract definitions, Functions, Contract Constructor and selfdestruct, Function Modifiers, Contract Inheritance, Error Handling, Events, Calling Other Contracts

Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEther Wallets , Ethereum Environment ,Infura, Etherscan, Ethereum Clients, Decentralized Application, MetaMask, Tuna Fish Use Case Implementation , OpenZeppelin Contracts, Best Practices for Ethereum Smart Contract Development.

Hyperledger Blockchain Implementation: Introduction, Use Case- Car Ownership Tracking, Hyperledger Fabric, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Applications, Best Practices for Chaincode Development

Advanced Concepts in Blockchain: Introduction, Interplanetary File System, Zero-Knowledge Proofs, Oracle-Interact, Self- Sovereignty Identity, Blockchain with IoT and AI/ML, Quantum Computing and Blockchain, Blockchain Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential

Self-Learning Component:

1. Security Audit of a Smart Contract: Choose an open-source smart contract from a public blockchain network (e.g., Ethereum). Conduct a security audit of the smart contract to identify potential vulnerabilities and suggest improvements to enhance its security. Provide a detailed report of the vulnerabilities found and the solutions proposed.
2. Decentralized Application (dApp) Development: Develop a decentralized application (dApp) that interacts with a smart contract on a public blockchain. The dApp can be related to finance, gaming, or any other domain of interest.

Implement functionalities like user authentication, interacting with the smart contract, and displaying relevant data on the dApp.

3. Legal and Regulatory Challenges of Blockchain: Research the legal and regulatory challenges faced by blockchain technology in a specific country or region. Write a comprehensive report discussing the current laws and regulations, the potential impact of blockchain adoption, and suggestions for overcoming regulatory hurdles.
4. Blockchain and IoT Integration: Explore how blockchain can be integrated with the Internet of Things (IoT) devices to enhance data integrity and security. Develop a proof-of-concept application where IoT devices record sensor data onto a blockchain and design a mechanism to ensure the authenticity of the data.

TEXTBOOKS:

1. Ambadas Tulajadas Choudhari, Arshad Sarfarz Ariff & Sham MR, “Blockchain for Enterprise Application Developers”, Wiley India Pvt Ltd, 2020
2. Andreas M. Antonopoulos, Dr. Gavin Wood, “Mastering Ethereum -Building Smart Contracts and DApps”, Ethereum Book LLC, Oreilly,2019.
3. Nitin Gaur, Luc Desrosiers, Venkatraman Ramakrishna, Petr Novotny, Dr. Salman A. Baset Anthony O'Dowd, “Hands-On Blockchain with Hyperledger-Building decentralized applications with Hyperledger Fabric and Composer”, Pact Publishing,2018.

REFERENCE BOOKS:

1. Melanie Swan, “Blockchain-Blueprint for a new economy”, Orielly,2015.
2. Vikram Dhillon, David Metcalf, Max Hooper, “Blockchain Enabled Applications-Understand the Blockchain Ecosystem and How to Make it Work for you”, Apress,2017.
3. Lorne Lantz, Daniel Cawrey, “Mastering Blockchain”, O'Reilly Media, Incorporated, 2020.
4. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing, 2018
5. Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, „Blockchain Technology: Cryptocurrency and Applications‟, Oxford University Press, first edition -2019.
6. 2. Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming‟, Create Space Independent Publishing Platform, First Edition - 2017.

JOURNALS/MAGAZINES:

1. https://soliditylang.org/
2. https://hyperledger-fabric.readthedocs.io/en/release-1.4/prereqs.html
3. https://hyperledger-fabric.readthedocs.io/en/release-2.5/
4. https://platon-truffle.readthedocs.io/en/v0.1.0/
5. https://trufflesuite.com/docs/
6. https://docs.metamask.io/
7. https://metamask.io/sdk/
8. https://remix.run/docs/en/main
9. https://remix-ide.readthedocs.io/en/latest/
10. https://geth.ethereum.org/docs
11. https://readthedocs.org/projects/web3js/
12. https://web3js.readthedocs.io/en/v1.10.0/
13. https://holbrook.no/share/doc/ethereum/web3js/1.0.0/
14. https://docs.web3js.org/
15. https://framework.embarklabs.io/docs/overview.html

SWAYAMNPTEL/MOOCs

1. https://onlinecourses.nptel.ac.in/

Course Title	**Data mining and Data warehousing**				**Course Type**		**SC**	
Course Code	**B24EIS713**	**Credits**	**3**		**Class**		**VII Semester**	
	LTP	**Credits**	**Contact Hours**	**Workload**	**Total number of Classes Per Semester**		**Assessment Weightage**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**-**	**-**	**-**				
	Practice	**-**	**-**	**-**	**Theory**	**Practical**	**CIE**	**SEE**
	Total	**3**	**3**	**3**	**42**		**50**	**50**

Prerequisites:

Database Management systems

Course Description:

Data warehousing and data mining are two major areas of exploration for knowledge discovery in databases. Data mining is for relatively unstructured data for which more sophisticated techniques are needed. The course aims to cover powerful data mining techniques including clustering, association rules. It then teaches high volume data processing mechanisms by building warehouse schemas such as snowflake, and star.

Course Objectives

The objectives of this course are to:

1. Describe the basic concepts of Data Warehouse and Data Mining techniques.

2. Illustrate the processing of raw data to make it suitable for various data mining algorithms.

3. Explain the measurement of interesting patterns in different databases

4. Discuss the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Course Outcomes (COs):

On successful completion of this course; the student will be able to:

CO1: Outline the basic concepts of Data Warehouse and Data Mining techniques.

CO2: Make use of preprocessing techniques to process raw data to make it suitable for various data mining algorithms.

CO3: Solve classification problems using by identifying suitable machine learning algorithm.

CO4: Apply the techniques of clustering to cluster real world data.

Program Outcomes

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2								3		
CO2	2	3	2	2	2	1						1		3	
CO3	2	2	2	2	2	1						1	3	3	
CO4	2	2	2	2	2	1						2		2	
CO5	2	3	3	2	2	2	2						2	2	2
CO6	2	2	2	3	2	2	2						2	2	2

Note: 1-Low, 2-Medium, 3-High

Course Contents:

Data Warehousing: Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses, Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata, Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube.

Data Mining: What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization

Association Analysis: Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative methods for generating Frequent Item sets, FP GROWTH Algorithm, Evaluation of Association Patterns.

Clustering: Clustering Techniques: Overview, features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis.

Self-learning component:

Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

TEXT BOOKS

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2007.

2. Jiawei Han and Micheline amber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2008.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

3. Data Mining and Knowledge Science – Springer.

4. Inderscience, The International Journal of Data mining, Modelling and Management5.IEEE, IEEE Transactions on Knowledge and Data Engineering.

Course Title	**Capstone Project Phase-1**				**Course Type**		**HC**	
Course Code	**B24EI0702**	**Credits**	**2**		**Class**		**VII Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes Per Semester**		**Assessment in Weightage**	
	Lecture	-	-	-				
	Tutorial	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	2	4	4				
	Total	**2**	**4**	**4**	-	**56**	**50**	**50**

COURSE OVERVIEW:

The major project is a two semester-long practical project with the main objective that students show their ability to apply theoretical concepts learned in lectures to solve (complex) practical problems. The results are to be presented in a project report and as an oral presentation. The major project must be completed as a teamproject. Team projects are limited to a minimum of two students to a maximum number of four students.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. To allow students to demonstrate a wide range of the skills learned during their course of study byasking them to deliver a product that has passed through the design, analysis, testing and evaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report andto give an oral presentation.

COURSE OUTCOMES (CO'S):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work toattain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering toolsnecessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmentalsustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing theproject work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing andpresenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysisrequired for carrying out the project.	11	1,2,3
O12	Engage in lifelong learning to improve knowledge and competence in thechosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

Blooms Level						
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low, 2-Medium, 3-High

The students are informed to follow the following instructions to complete the Project Phase-1:

- Student should carry out project work in a group which is formed in the VII semester. Student mustselect group members from the same section as they belong to and select a faculty member from department of CSE as aninternal project guide based on research domain and expertise. Student may optionally also select external guide bearing domain expertise from different departments within University and Industry to carry out multidisciplinary project.
- Student group must propose a project title, after consultation with guides and after carrying out a literature survey. The proposed title must be submitted in form a document (synopsis) that contains the proposed title of the project, an abstract, Introduction, Survey, Feasibility, and cost estimation tocarry out the project.
- Further with the help of respective guide, each student group have to the literature review based onthe literature survey, identify the research gaps in the selected research/project domain, and then finalize the problem statement and objectives for the project.
- Each student groups shall be reviewed and evaluated in two reviews through the semester.
- Review 1 shall be on the presentation of the synopsis and justification of the title and feasibility ofthe project
- Review 2 shall be on the presentation on the literature survey carried out.

Finally, the Project Phase-1 shall conclude with each project group apply for idea patent or copyright andpublish a survey paper in SCOPUS indexed journals, write research proposals for fundings from various governmental organizations or industries.

Course Title	**Internship/Global Certification**				**Course Type**		**HC**	
Course Code	**B24EI0703**	**Credits**	**2**		**Class**		**VII Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes**		**Assessment in**	
	Lecture	-	-	-				
	Tutorial	-	-	-	**Theory**	**Practical**	**CIE**	**SEE**
	Practical	2	4	4				
	Total	**2**	**4**	**4**	-	56	**50**	**50**

COURSE OVERVIEW:

An internship can present students with new skills and opportunities. Interns not only gain technical knowledge within the industry of their choice, but they also learn how to interact with professionals in aworkplace setting, and develop essential soft skills like time management, organization, adaptability, problem-solving and teamwork.

COURSE OBJECTIVES:

The objectives of this course are to

1. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
2. To encourage team work.
3. To help students to gain exposure into industries.
4. To improve students' communication skills by asking them to produce both a professional report andto give an oral presentation.

COURSE OUTCOMES:

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project workto attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing theproject work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysisrequired for carrying out the project.	11	1,2,3
O12	Engage in lifelong learning to improve knowledge and competence in thechosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low,2-Medium,3-High

The students are informed to follow the following instructions to complete the Internship:

1. The internship should be paid internship in IT industry.
2. The internship should be for minimum of three months.
3. The project title must be submitted in form a document (synopsis) that contains the proposed titleof the project, an abstract, Introduction and their roles and responsibilities in company.
4. Each student shall be reviewed and evaluated in two reviews through the semester.
5. Review 1 shall be on the presentation of the synopsis.
6. Review 2 shall be on the presentation on the roles and responsibilities carried out with module completion results (as applicable)

VIII SEMESTER

VIII Semester												
Sl. No	**Course Code**	**Title of the Course**	**HC/FC/ SC/OE /MC**	**Credit Pattern**				**Contact Hours/ Week**	**Examination**			**AICTE Course category**
				L	**T**	**P**	**Total**		**CIE Marks**	**SEE Marks**	**Total Marks**	
1	B24EI0801	Security and Privacy in IoT	HC	3	0	0	3	3	50	50	100	PCC
2	B24EI0802	Capstone project phase-II	proj	0	0	10	10	20	50	50	100	Proj
3	B24EI0803	Internship/Global Certification	HC	0	0	2	2	4	50	50	100	Intern
TOTAL				**3**	**0**	**12**	**15**	**27**	**150**	**150**	**300**	
TOTAL SEMESTER CREDITS					**15**							
TOTAL CUMULATIVE CREDITS					**160**							
TOTAL CONTACT HOURS					**27**							
TOTAL MARKS					**300**							

Course Title	Security and Privacy in IoT				Course Type	HC	
Course Code	B24EI0801	Credits	3		Class	VIII Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester	Assessment in Weightage	
	Lecture	3	3	3			
	Tutorial	-	-	-	Theory	CIE	SEE
	Practical	-	-	-			
	Total	3	3	3	42	50	50

Course Overview:

The course is to provide an insights of security issues, information security, privacy of security, different techniques, error correction mechanism for cyber security in IoT perspective. s IoT privacy and security is important because hackers can exploit the vulnerabilities of IoT devices and access sensitive data or cause harm. Privacy and security challenges include improper device updates, lack of efficient and robust security protocols, user unawareness, and famous active device monitoring

Course Objective:

The objectives of this course are to:

1. Learn the basics of security and various types of security issues.
2. Study different cryptography techniques available and various security attacks.
3. Explore network security and how they are implemented in real world.
4. Get an insight of various issues of Web security and biometric authentication.
5. Know about the different security protocols

Course Outcomes (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the Security requirements in IoT System.	1,2	1,2
CO2	Illustrate the concept of vulnerabilities – different attacks in IoT Framework	1,2,3	1,2
CO3	Analyse the authentication credentials and access management solution for a particular application.	1,2,3,8,12	2,3
CO4	Explain the various types of Trust models for IoT	2,3,4 12	1,2,3
CO5	Solve IoT security problems using light weight cryptography.	4,5,8,12	2,3
CO6	Conclude security systems using elementary blocks	1,2,3,9,10	2,3

BLOOM'S LEVEL OF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√				

CO3				√		
CO4					√	√
CO5			√			
CO6					√	

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	3	1	2	1	2	-	-	-	-	1	-	2
CO2	3	1	1	3	1	2	-	2	-	-	-	-	1	-	2
CO3	3	1	1	3	1	2	-	2	-	-	-	-	2	-	2
CO4	3	1	1	3	1	2	-	2	-	-	-	-	2	-	3
CO5	2	1	1	3	1	2	-	2	1	-	-	1	1	1	2
CO6	2	1	1	3	1	2	-	2	1	-	-	1	2	1	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Overview of Security and Privacy in IoT, Requirements and Architecture in IoT, Privacy and Trust in IoT-Data-Platforms for Smart Cities, Secure Platform, Data Aggregation for the IoT in Smart Cities. Vulnerabilities, Attacks, and Countermeasures: Primer on threats, vulnerability, and risk (TVR) , Common IoT attack types , Attack trees, Fault tress. Cyber physical systems- IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures), security engineering for IoT development, IoT security lifecycle.

Security Engineering for IoT and Security Life cycle of IoT: Building security into design Development: Security in agile developments, Focusing on IoT device in operation; Secured Design: Safety and security design, Process and agreements, Technology Section-Security products, and Services; The secure IoT system implementation lifecycle: Implementation, Operations and maintenance, Dispose.

IOT Reference Model – Introduction - Functional View, IoT Security Challenges-Hardware Security Risks -Hardcoded/Default Passwords – Resource Constrained Computations -Legacy Assets Connections - Devices Physical Security, Software Security Risks -Software Vulnerabilities.
Trust Models for IoT - Authentication in IoT- Computational Security for the IoT- Privacy-Preserving Time Series Data Aggregation.

Cloud Security for IoT Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing. Internet of things security - Security and Impact of the Internet of Things (IoT) on Mobile Networks- Networking Function Security.

Text Books

1.Practical Internet of Things Security by Brian Russell, Drew Van Duren
2.Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations.

3.Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, Orient Blackswan Private Limited - New Delhi, 2015 1st Edition,
4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2014
5. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1- 44939357-1
6. Hu, Fei. Security and privacy in Internet of things (IoTs): Models, Algorithms, and Implementations, 1st edition,CRC Press, 2016.

7. Russell, Brian, and Drew Van Duren. Practical Internet of Things Security, 1st edition, Packt Publishing Ltd, 2016.

References Books:

1. Whitehouse O. Security of things: An implementers’ guide to cyber-security for internet of things devices and beyond, 1st edition, NCC Group, 2014

2. DaCosta, Francis, and Byron Henderson. Rethinking the Internet of Things: a scalable approach to connecting everything, 1st edition, Springer Nature, 2013.

SWAYAM NPTEL/MOOCs:

1. https://www.udemy.com/topic/computer-network/
2. Swayam
3. https://www.coursera.org/courses?query=computer%20network
4. https://nptel.ac.in/courses/106/105/106105183/
5. https://www.edx.org/learn/computer-networking

<table>
<tr><td>Course Title</td><td colspan="4">Capstone Project Phase-II</td><td colspan="2">Course Type</td><td colspan="2">Project</td></tr>
<tr><td>Course Code</td><td>B24EI0802</td><td>Credits</td><td colspan="2">10</td><td colspan="2">Class</td><td colspan="2">VIII Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes</td><td colspan="2" rowspan="2">Assessment in</td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>10</td><td>20</td><td>20</td></tr>
<tr><td>Total</td><td>10</td><td>20</td><td>20</td><td>-</td><td>280</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

Project Phase-2 is continuation of Project Phase-1 from semester VII.

COURSE OBJECTIVE (S):

The objective of this course are to

1. To allow students to demonstrate a wide range of the skills learned during their course of study by askingthem to deliver a product that has passed through the design, analysis, testing and evaluation.
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and togive an oral presentation

COURSE OUTCOMES (CO'S):

On successful completion of this course, the student shall be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	11	1,2,3
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low, 2-Medium, 3-High

The students are informed to follow the following instructions to complete the Project Phase-2:

1. Each student group shall, conduct the required experiment to implement the proposed project with theconsultation of respective guides.

2. Each student groups shall be reviewed and evaluated in two reviews through the semester and finallyeach group shall demonstrate the completed project to a team of examiners.
3. Review 1 shall be on the presentation of the methodology employed and model created.
4. Review 2 shall be on the presentation on the functional project.
5. Finally, the Capstone-Project Phase-2 shall conclude with each project group apply for patent or copyrightand publish a paper in SCOPUS indexed journals. In Semester end examination, each student in groups shall be evaluated, based on the course outcomes.

<table>
<tr><td>Course Title</td><td colspan="4">Internship/Global Certification</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B24EI0803</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">VIII Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes</td><td colspan="2" rowspan="2">Assessment in</td></tr>
<tr><td>Lecture</td><td></td><td></td><td></td></tr>
<tr><td>Tutorial</td><td></td><td></td><td></td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>2</td><td>4</td><td>4</td></tr>
<tr><td>Total</td><td>2</td><td>4</td><td>4</td><td></td><td>56</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

An internship can present students with new skills and opportunities. Interns not only gain technical knowledge within the industry of their choice, but they also learn how to interact with professionals in aworkplace setting, and develop essential soft skills like time management, organization, adaptability, problem-solving and teamwork.

COURSE OBJECTIVES:

The objective of this course are to

1. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
2. To encourage team work.
3. To help students to gain exposure into industries.
4. To improve students' communication skills by asking them to produce both a professional report andto give an oral presentation.

COURSE OUTCOMES:

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic	1	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project workto attain substantiated conclusions.	2	1,2,3
CO3	Design solutions to the chosen project problem.	3	1,2,3
CO4	Undertake investigation of project problem to provide valid conclusions.	4	1,2,3
CO5	Use the appropriate techniques, resources, and modern engineering tools necessary for project work.	5	1,2,3
CO6	Apply project results for sustainable development of the society.	6	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7	1,2,3
CO8	Understand professional and ethical responsibilities while executing theproject work.	8	1,2,3
CO9	Function effectively as individual and a member in the project team.	9	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	10	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysisrequired for carrying out the project.	11	1,2,3
O12	Engage in lifelong learning to improve knowledge and competence in thechosen area of the project.	12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

	Bloom’s Level					
CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3						√
CO4				√		
CO5			√			
C06			√			
CO7		√				
CO8		√				
CO9	√			√		
CO10			√			√
CO11		√		√		
CO12			√			

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2		3											3	3	3
CO3			3										3	3	3
CO4				3									3	3	3
CO5					3								3	3	3
C06						3							3	3	3
CO7							3						3	3	3
CO8								3					3	3	3
CO9									3				3	3	3
CO10										3			3	3	3
CO11											3		3	3	3
CO12												3	3	3	3

Note: 1-Low,2-Medium,3-High

The students are informed to follow the following instructions to complete the Internship:

1. The internship should be paid internship in IT industry.
2. The internship should be for minimum of three months.
3. The project title must be submitted in form a document (synopsis) that contains the proposed titleof the project, an abstract, Introduction and their roles and responsibilities in company.
4. Each student shall be reviewed and evaluated in two reviews through the semester.
5. Review 1 shall be on the presentation of the synopsis.
6. Review 2 shall be on the presentation on the roles and responsibilities carried out with module completion results (as applicable).

REVA
UNIVERSITY
Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli
Yelahanka, Bengaluru - 560 064
Karnataka, India.

Ph: +91- 90211 90211, +91 80 4696 6966
E-mail: admissions@reva.edu.in

www.reva.edu.in

Follow us on

/revauniversity_official /REVAUniversity

/revauniversity_official /@revauniversity_official /REVA University

reva.edu.in +91 90211 90211