

ಸ್ಥಾಪನೆ: ೨೦೧೭

Centenary Celebrated Sharnbasveshwar Vidya Vardhaka Sangha's

Estd. : 2017



ಶರಣಬಸವ  
SHARNBASVA  
ಕಲಬುರಗಿ - ೫೮೫ ೧೦೩



ವಿಶ್ವವಿದ್ಯಾಲಯ  
UNIVERSITY  
KALABURAGI - 585 103



A State Private University approved by Govt. of Karnataka vide Notification No. ED 144 URC 2016 dated 29-07-2017  
Recognised by UGC under Section 2f vide No. F.8-29/2017 (CPP-I/PU), dated 20-12-2017 & AICTE, CoA, PCI New Delhi

# CURRICULUM

## Outcome Based Education

### 2022 - 2023

## ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

**III & IV SEMESTER B. Tech.**

**FACULTY OF ENGINEERING ANF TECHNOLOGY  
(EXCLUSIVELY FOR WOMEN)  
SHARNBASVA UNIVERSITY, KALABURAGI**

## About Sharnbasva University

Sharnbasva University established in the year 2017, is the first private multi-disciplinary university in the entire North Karnataka providing avenues for students to pursue higher education in almost all fields of education such as Engineering, Management, Science, commerce, Architecture, Pharmaceutical Sciences, Humanities, and Social Sciences. Providing quality education at an affordable cost has been the hallmark of the university. The university has set itself on the path to one of the emerging centres of excellence and a world-class University, which is the dream of Poojya Dr. Sharnbaswappa Appa, the visionary chancellor of the youngest private university in the entire state.

The Sharnbasva University is backed by the rich legacy of more than 100 years of providing quality education to the deprived sections of the people in the educationally backward Kalaburagi and neighbouring districts. The Sharnabasaveshwar Vidya Vardak Sangha, under whose aegis the Sharnbasva University is functioning, has the honor of starting the first school exclusively for girls way back in 1934 opening doors of learning to the girls. The legacy of providing optimum importance to girl education has continued to this day and the Sangha was the first to start an exclusive engineering college for women in the entire North Karnataka and the second in the entire Karnataka. This College is now part of Sharnbasva University. The university houses five Center of Excellence (CoE) in Artificial Intelligence, Machine Learning, the Internet of Things, Drone Technology, 5G and 6G Technology Lab.

### The institution offers:

- 4-year undergraduate program - Bachelor of Technology (in Artificial Intelligence & Data Science, Civil, Computer Science, Computer System Design, Energy Engineering, Electronics & Communication, Electrical & Electronics, Mechanical).
- 4-year undergraduate program (Exclusively for Women) - Bachelor of Technology (in Artificial Intelligence & Machine Learning, Civil, Computer Science, Electronics & Communication, Electrical & Electronics, Mechanical).
- 2-Year Post Graduate Programs - Master of Technology (Structural Engineering, VLSI Design & Embedded Systems, Machine Design, Computer Science and Engineering, Computer Network Engineering, Artificial Intelligence and Data Science, Digital Electronics) and Ph. D Programs
- 2-Year Post Graduate Programs - Master of Technology (Exclusively for Women) (Computer Science and Engineering, Digital Communication and Networking) and Ph. D Programs
- 5 Years Under program – Bachelor of Architecture (B. Arch.)
- 3-Year undergraduate programs – Bachelor of Computer Applications (BCA), – Co-Education and Exclusively for Women, Bachelor of Business Administration (BBA) BBA (HR, Finance and Marketing)– Co-Education and Exclusively for Women, BBA (Logistics), BBA (Tourism & Travel Mgmt.), BBA (Aviation and Air cargo) for Exclusively for Women.

- 2-Year Post Graduate programs - Master of Computer Application (MCA) and Ph. D Programs.
- 2-Year Post Graduate programs - Master of Business Administration (MBA) – Co-Education and Exclusively for Women, MBA (Tourism), MBA (Hospital Administration). Master of Commerce and Ph. D programs.
- 2-Year Post Graduate Programs – Master of Arts (MA) – MA (Kannada, English), MA (Fine Arts), MA (Journalism and Mass Comm.), MA (Music), MA (Visual Arts) and Ph. D Programs.
- 2 Year Post Graduate Programs – Master of Science (M. Sc.) – M. Sc. (Physics), M. Sc. (Mathematics), M. Sc. (Botany), M. Sc. (Zoology) and Ph. D Programs.

#### **University Vision:**

- Enhancing the horizon of world knowledge by promoting international understanding through imparting quality education and creating value added skill based human resource.
- We aspire to become top ranking National and International Centre of Excellence producing high caliber leaders and captains of Industry.
- Inculcating the spirit of "Vasudaiva Kudumbakam" (The world is one family).
- "Sakala Jeevathmarige Lesane Bayasuva" (Wishing the worldly good and betterment of all the living beings) is our moto.

#### **University Mission**

- Achieving academic excellence through innovatively designed, research intensive, industry-oriented education.
- Imbibing the culture of independent thinking, independent writing, independent speaking and independent living among the students in all the activities.
- Foster the spirit of National development and develop global competencies. Nurture creativity and encourage entrepreneurship and provide an education with rigor and relevance.
- Provide academically excellent, time efficient, and cost-effective higher education. Provide an education which enhances the ability of students to learn throughout the life.
- Ensure freedom of thought and expression and a campus without discrimination. Encourage the spirit of questioning and ensure close inter-relationship between Teaching, Scholarship and Research.
- Develop and deliver distinctive and value driven academic programme that are flexible and responsible to Local, National and International needs.
- Cultivate academic, business and community driven partnership that positions the University as a leading choice for adult learners.
- To work effectively with other institutions and organisations, where such partnerships can lead to understanding research and teaching.

#### **About Faculty of Engineering and Technology (Exclusively for Women):**

The Faculty of Engineering and Technology (Exclusively for Women) (FETW), formerly known as Godutai Engineering College for Women, was established in 2017. It is the only women's engineering college in the entire northern backward part of Karnataka state, meeting the rapidly growing need for women professionals in technology. Nurturing young minds in an innovative and progressive learning environment, we are committed to promoting technical education as a catalyst for the country's and society's growth and development, a dream of our Chancellor and President, Poojya Dr. Sharnbaswappa Appa. With world-class infrastructure and experienced faculty, the Faculty of Engineering and Technology is the preferred destination for technocrats shaping the future.

FETW offers the following B.Tech. (Undergraduate) programs:

- Artificial Intelligence and Machine Learning (AI & ML) - 60 seats
- Civil Engineering (CV) - 60 seats
- Computer Science and Engineering (CSE) - 150 seats
- Electrical and Electronics Engineering (EEE) - 60 seats
- Electronics and Communication Engineering (ECE) - 120 seats

M. Tech. (Postgraduate) programs:

- Computer Science and Engineering (CSE) - 18 seats
- Digital Communication and Networking (DCN) - 18 seats

Research Programs (Ph.D.):

- Computer Science and Engineering
- Electronics and Communication Engineering
- Electrical and Electronics Engineering
- Basic Sciences (Physics, Chemistry, Mathematics)

### **Vision of the Institute**

**We aspire to become global model for women professional through quality education and ethical values in the field of engineering and technology.**

### **Mission of the Institute**

- **To inspire a research culture, encourage entrepreneurial efforts and empower globally to be great leaders.**
- **To create technical women's power to meet the current and future demand of the industry.**
- **To develop women professionals with good academic knowledge, technical skills, strong ethics and above all good human being.**

### **About the Department:**

The Department of B. Tech. in Artificial Intelligence and Machine Learning (AI and ML) at the Faculty of Engineering and Technology (Exclusively for Women) was established in the year 2021 with an intake of 60 students. It is a four-year full-time undergraduate program recognized by the All-India Council for Technical Education (AICTE). Artificial Intelligence and Machine Learning aim to develop a strong foundation by using principles and technologies that consist of many facets of Artificial Intelligence, including logic, knowledge representation, probabilistic models, and machine learning.

To nourish the young minds, the department has a team of dedicated and experienced faculty with good infrastructure, curriculum, comprehensive hands-on experience, and conducting research in the field of Artificial Intelligence & Machine Learning. The department has well-equipped laboratories with higher configuration systems along with a smartboard available in the laboratory to provide the best to the students. The department has a wide technical spectrum through the centre of excellence, special labs, industrial tie-ups, collaborations, MOUs, and online forums.

### **Vision**

To train women professionals to create sustainable, intelligent solutions that work with natural intelligence to empower future generations digitally while protecting social ethics.

### **Mission**

1. To provide female students with the necessary foundational skills to pursue a successful career in the field of computer science and engineering, with a focus on artificial intelligence and machine learning.
2. To Improve academic outcomes through location-based education and relationships with established research laboratories and enterprises.
3. To Inspire young women to pursue entrepreneurial endeavours and help them grow into influential leaders.

### **Program Educational Outcomes (PEOs)**

After a few years of graduation with a B. Tech. in Artificial Intelligence and Machine Learning, the girl graduates will be able:

- PEO-1: To analyse the problems by applying the principles of computer science, mathematics, and scientific investigation to build intelligent machines, software, or applications using the latest technologies to solve problems of the real world.
- PEO-2: To start an enterprise to improve the economy of the country by providing support to the customer for a lifelong learning attitude.
- PEO-3: To Pursue higher studies with research potential in the field of Artificial intelligence, Engineering in allied areas and continue to learn by participating in conferences, and seminars, etc.

### **Program Outcomes (POs)**

On successful completion of the program, the graduates of the B. Tech. in Artificial Intelligence and Machine Learning program will be able to:

- **PO 1: Engineering knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals for the solution of complex problems in Artificial Intelligence and Machine Learning.
- **PO 2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using the first principles of mathematics, nature, and engineering sciences.
- **PO 3: Design/development of solution:** Design solutions for complex engineering problems and design system components, and processes to meet the specifications with consideration for public health and safety, and cultural, societal, and environmental considerations.

- **PO 4: Conduct Investigation of a complex problem:** 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: Engineering 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 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 multidisciplinary settings.
- **PO 10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective report 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 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.

### **Program-Specific Outcomes (PSOs)**

Upon successful completion of the B. Tech. in Artificial Intelligence and Machine Learning (AI and ML) program, graduates will possess the following abilities:

**PSO 1:** Understand, analyze, and develop vital skills in areas related to computer science and artificial intelligence, with a focus on underlying statistical and computational principles. Apply this knowledge to solve practical problems.

**PSO 2:** Demonstrate the ability to implement AI and ML techniques, including search algorithms, neural networks, machine learning, and data analytics, for solving problems and designing novel algorithms. Develop skills essential for a successful career and entrepreneurship.

**PSO 3:** Utilize modern tools and techniques in computer science, artificial intelligence, and data science.

**Semester wise Credit Breakdown for B. Tech. Degree Curriculum Batch 2021-24**

	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eight	Total Credits
<b>Basic Sciences (BSC)</b>	7	7	3	3	-	-	-	-	20
<b>Engineering Sciences (ESC)</b>	10	10	-	-	-	-	-	-	20
<b>Humanities, Social Sciences and Management (HSMC)</b>	1	1	1	1	-	4	1	-	9
<b>Ability Enhancement Course (AEC)</b>	1	1	1	1	1	1	-	-	6
<b>Professional Core Courses (PCC)</b>	-	-	15	15	12	5	12	-	59
<b>Professional Elective Courses (PEC)</b>	-	-	-	-	3	6	3	-	12
<b>Institutional Open Elective Courses (IOE)</b>	-	-	-	-	4	4	4	-	12
<b>Internship (INT)</b>	-	-	-	-	-	-	-	7	7
<b>Mini Project / Project Work (PW)</b>	1	1	1	1	1	1	1	8	15
<b>Total Credits</b>	<b>20</b>	<b>20</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>15</b>	<b>160</b>

Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2022-23

[As Per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

(Effective from the academic year 2022-23)

**Programme: B.Tech: Artificial Intelligence and Machine Learning**

**III SEMESTER**

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination			Credits	
					Theory Lecture	Tutorial	Practical/ Drawin	Duration inHours	CIE Marks	SEE Marks		Total Mark
					L	T	P					
1	BS	22MATS31	Mathematics for CSS-III	Mathematics	3			3	50	50	100	03
2	PCC	22AM32	Digital Design & Computer Organization	CSE/ AIML	3	1		3	50	50	100	04
3	PCC	22AM33	Data Structures and Applications	CSE/ AIML	2	1		3	50	50	100	03
4	PCC	22AM34	Operating System	CSE/ AIML	2	1		3	50	50	100	03
5	PCC	22AM35	Object Oriented Programming with JAVA	CSE/ AIML	2	1		3	50	50	100	03
6	PCC	22AML36	Data Structures and Applications Lab	CSE/ AIML			2	3	50	50	100	01
7	PCC	22AML37	Operating System Lab	CSE/ AIML			2	3	50	50	100	01
8	PCC	22AML38	Object Oriented Programming with JAVA Lab	CSE/ AIML			2	3	50	50	100	01
9	PW	22PRJ39	Project-III	CSE/ AIML			2	3	50	50	100	01
10	HSS	22HSM310A	Soft Skills and Personality Development	Humanities	1			3	50	50	100	01
11	AEC	22AM311X	Ability Enhancement Course-III	CSE/ AIML			2	3	50	50	100	01
<b>Total</b>					<b>13</b>	<b>4</b>	<b>10</b>	<b>33</b>	<b>550</b>	<b>550</b>	<b>1100</b>	<b>22</b>

Note: BS-Basic Science, PCC- Programme Core Course, PW-Project Work, AEC- Ability Enhancement Course, HSS-Humanity and Social Science, NCMC - Non-Credit Mandatory Course

Project (PRJ): A Batch of 4 students, Same Branch or Different Branches with a Guide, may undertake one project.

**Ability Enhancement Course-3**

Course code under 22AEC311X	Course Title
22AM311A	Unix and Shell Programming
22AM311B	Data Analytics with Excel

**Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

12	NCM C	22MATDIP31	Additional Mathematics – I	Mathematics	2	-	-	-	100	00	100	00
----	----------	------------	----------------------------	-------------	---	---	---	---	-----	----	-----	----

- 1) Non Credit Mandatory Courses (NCMC) Additional Mathematics-I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of B. Tech. programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the university examination. In case any student fails to register for the said course/fails to secure the minimum 50% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.
- 2) These courses shall not be mandatory for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**Courses prescribed to lateral entry B.Sc. degree holders admitted to III semester of Engineering programs**

Lateral entry students from B.Sc. stream, shall clear the non-credit courses Computer Aided Engineering Drawing, Elements of Civil Engineering of First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**AICTE Activity Points to be earned by students admitted to B.Tech. programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines):**

Over and above the academic grades, every regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other universities to fifth semester are required to earn 50 activity points from the year of entry to Sharnbasva University. The- Activity Points earned shall be reflected on the students eighth semester Grade card. The activities can be spread over the years, anytime during the semester weekends holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity points, eighth semester Grade Card shall be issued only after earning the required activity points.

Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

**Sharnbasva University, Kalaburagi Scheme of Teaching and Examination 2022-23**  
**[As Per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]**  
 (Effective from the academic year 2022-23)

**Programme: B. Tech: Artificial Intelligence and Machine Learning**

**IV SEMESTER**

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/ week			Examination			Credits	
					Theory Lecture	Tutorial	Practical / S	Duration in Hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	BS	22MATS41	Mathematics For CSS-IV	Mathematics	2	1		3	50	50	100	03
2	PCC	\$22AM42	Design and Analysis of Algorithms	CSE/AI ML	2	1		3	50	50	100	03
3	PCC	*22CS43	Data Base Management System	CSE/AI ML	2	1		3	50	50	100	03
4	PCC	*22CS44	Python Application Programming	CSE/AI ML	2	1		3	50	50	100	03
5	PCC	22AM45	Fundamentals of Artificial Intelligence	CSE/AI ML	2	1		3	50	50	100	03
6	PCC	#22UHV410	Universal Human Values	CSE/AI ML			2	3	50	50	100	01
7	PCC	\$22AML46	Design and Analysis of Algorithms Lab	CSE/AI ML			2	3	50	50	100	01
8	PCC	22CSL47	Data Base Management Lab	CSE/AI ML			2	3	50	50	100	01
9	PW	22AML48	Artificial Intelligence Lab	CSE/AI ML			2	3	50	50	100	01
10	HSS	22PRJ49	Project-IV	Humanities	3			2	50	50	100	03
11	AEC	*22ACS411B	Scripting Languages	CSE/AI ML			2	3	50	50	100	01
<b>Total</b>					<b>13</b>	<b>5</b>	<b>10</b>	<b>32</b>	<b>550</b>	<b>550</b>	<b>1100</b>	<b>23</b>

Note: BS-Basic Science, PCC- Programme Core Course, PW-Project Work, AEC- Ability Enhancement Course, HSS-Humanity and Social Science, NCMC-Non-Credit Mandatory Course

Project (PRJ): A Batch of 4 students (Same Branch or Different Branches with a Guide, May undertake one project.												
<b>Ability Enhancement Course-4</b>												
<b>Course code under 22AEC411X</b>						<b>Course Title</b>						
22AM411A						Ethics & Public policy of AI						
22AM411B						Scripting Languages						
<b>Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs</b>												
10	NCMC	22MATDIP41	Additional Mathematics – II	Mathematics	2	-	-	-	100	00	100	00
<p>1) Non Credit Mandatory Courses (NCMC) Additional Mathematics-I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of B. Tech. programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the university examination. In case any student fails to register for the said course/fails to secure the minimum 50% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.</p> <p>2) These courses shall not be mandatory for vertical progression, but completion of the courses shall be mandatory for the award of degree.</p>												
<b>Courses prescribed to lateral entry B.Sc. degree holders admitted to III semester of Engineering programs</b>												
Lateral entry students from B.Sc. stream, shall clear the non credit courses Computer Aided Engineering Drawing, Elements of Civil Engineering of First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.												

**AICTE Activity Points to be earned by students admitted to B.Tech. programme (For more details refer to Chapter 6,AICTE Activity PointProgramme, Model Internship Guidelines):**

Over and above the academic grades, every regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other universities to fifth semester are required to earn 50 activity points from the year of entry to Sharnbasva University. The Activity Points earned shall be reflected on the students eighth semester Grade card.

The activities can be spread over the years, anytime during the semester weekends holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours requirement should be fulfilled. Activity Points (noncredit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b>			
As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
<b>III Semester, w.e.f 2023-24</b>			
<b>Digital Design &amp; Computer Organization</b>			
<b>Course Code</b>	<b>22AM32</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number Lecture Hour/Week (L:T:P)</b>	<b>3:1:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Number of Lecture Hours</b>	<b>40 Theory and 16 Practical</b>	<b>Exam Hours</b>	<b>03</b>
<b>Credits-04</b>			

<b>Course Learning Objectives:</b> This course will enable students to
<ul style="list-style-type: none"> <li>Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.</li> </ul>
<ul style="list-style-type: none"> <li>Describe and Design multiplexers, Binary comparators, and Master-Slave Flip-Flops, registers and counters.</li> </ul>
<ul style="list-style-type: none"> <li>Understand the working of computer systems and its basic principles.</li> </ul>
<ul style="list-style-type: none"> <li>Understand instruction level architecture and instruction execution.</li> </ul>
<ul style="list-style-type: none"> <li>Understand the current state of art in memory system design.</li> </ul>

MODULE NO.	TOPICS	TEACHING HOURS	RBT LEVEL
1	<b>Introduction to Digital Design:</b> Boolean Functions, Digital Logic Gates, Introduction, The Map Method: Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language - Verilog Model of a simple circuit, The Quine-Mc Clusky method.	8	L1, L2, L3
2	<b>Combinational Logic:</b> Introduction, Combinational circuits, Design Procedure, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits - Adder, Multiplexer, Encoder. <b>Sequential Logic:</b> Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.	10	L1, L2, L3
3	<b>Basic Structure of Computers:</b> Functional Units, Basic Operational Concepts, Bus structure, Performance -Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. <b>Machine Instructions and Programs:</b> Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes, Basic Input/output organization	10	L1, L2, L3

4	<b>Input/output Organization:</b> Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Buses, Interface circuits, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions, Performance considerations.	10	L1, L2, L3
5	<b>Basic Processing Unit:</b> Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction, Multiple bus organization, Hardwired Control, Microprogrammed Control. <b>Pipelining:</b> Basic concepts: Role of Cache memory, Pipeline Performance, Data hazards	10	L1, L2, L3
<b>PRACTICAL COMPONENTS</b>			
<b>Experiments: Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant</b>			
<ol style="list-style-type: none"> <li>1. Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.</li> <li>2. Design a 4-bit full adder and subtractor and simulate the same using basic gates.</li> <li>3. Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioral model.</li> <li>4. Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.</li> <li>5. Design Verilog HDL to implement Decimal adder.</li> <li>6. Design Verilog program to implement Different types of multiplexers like 2:1, 4:1 and 8:1.</li> <li>7. Design Verilog program to implement types of De-Multiplexer.</li> <li>8. Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.</li> </ol>			

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	Apply Karnaugh Map (K-Map) techniques for the simplification of diverse Boolean expressions.
CO2	Design different types of combinational and sequential circuits, accompanied by corresponding Verilog programs for their implementation.
CO3	Describe the basics of machine instructions, addressing modes, and processor performance.
CO4	Illustrate the approaches involved in achieving the communication between a processor and I/O devices.
CO5	Analyze the internal structure of memory and impact of cache and pipelining on the performance of a processor

Mapping of course outcomes with program outcomes

TEXTBOOKS:

1. Carl Hamacher, Z. Vranesic & S. Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2002.
2. Donald P Leach, Albert Paul Malvino & Goutham Saha: Digital Principles and Applications, 8<sup>th</sup> Edition, Tata McGraw Hill, 2015.

REFERENCE BOOKS:

1. Morris Mano, "Computer System Architecture", PHI, 1986. William Stallings Computer, Organization & Architecture, 7th Edition, PHI 2006.
2. R D Sudhakar Samuel: Illustrative approach to Logic Design, Sanguine-Pearson, 2010.

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b> As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) <b>III Semester, w.e.f 2023-24</b>			
<b>Data Structures and Applications</b>			
<b>Course Code</b>	<b>22AM33</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number Lecture Hour/Week (L: T:P)</b>	<b>2:1:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Number of Lecture Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>
<b>Credits-03</b>			

**Course Objectives:** This course will enable students to

- Understanding the fundamentals of data structures, including pointers, arrays, strings, linked lists, stacks, queues, trees, and graphs.
- Understand dynamic memory allocation and deallocation in C using functions
- Study and implement graphs and tree traversal techniques.
- Learn and implement common searching algorithms (e.g., linear search, binary search) and sorting algorithms (e.g., bubble sort, selection sort, merge sort, quick sort) using various data structures.
- Implement hash tables and use them for efficient data retrieval.

MODUL E NO.	TOPICS	TEACHI NG HOURS	RBT LEVELS
<b>1</b>	<p><b>Introduction:</b> Data Structures, Classifications (Primitive &amp; Non-Primitive), Data structure operations, Representation of Linear Arrays in Memory, dynamically allocated arrays. Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions.</p> <p><b>Array Operations:</b> Traversing, inserting, deleting, Searching: Linear Search, Binary Search, and Sorting: Bubble Sort. Multidimensional Arrays, Polynomials: Polynomial Representation, Polynomial Addition, Sparse Matrices: Sparse Matrix Representation, Transposing Matrix.</p> <p><b>Strings:</b> Basic Terminology, Operations and Pattern Matching algorithm: Naïve String-Matching algorithm. Programming Examples.</p>	<b>10</b>	<b>L1, L2, L3</b>
<b>2</b>	<p><b>Stacks:</b> Definition, Stack Operations, Array Representation of Stacks and Stack Applications: Infix to postfix conversion, evaluation of postfix expression.</p> <p><b>Recursion:</b> Factorial, Fibonacci Sequence, Tower of Hanoi.</p> <p><b>Queues:</b> Definition, Array Representation. Queue Operations, Circular Queues, Dequeue, Priority Queues. Programming Examples.</p>	<b>9</b>	<b>L1, L2, L3</b>
<b>3</b>	<p><b>Linked Lists:</b> Definition, Representation of linked lists in Memory, Memory allocation and Linked list operations:</p>	<b>9</b>	<b>L1, L2, L3</b>

	Traversing, Searching, Insertion, and Deletion. Doubly Linked lists. Linked Stacks and Queues. Programming Examples		
4	<b>Trees:</b> Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations-copying binary tree, testing equality. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion (An empty left sub tree and nonempty right sub tree and vice-versa), Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples.	6	L1, L2, L3
5	<b>Graphs:</b> Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. <b>Sorting Techniques:</b> Insertion Sort, Radix sort, selection sort. <b>Hashing:</b> Collision concept, Linear Probing, quadratic probing, double hashing examples.	6	L1, L2, L3

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	Illustrate the different data structures and their applications.
CO2	Apply Arrays, Stacks, and Queue data structures to solve the given problems.
CO3	Use the concept of a linked list in problem-solving.
CO4	Develop solutions using trees to model the real-world problem.
CO5	Develop solutions using graphs to model real-world problems and explain advanced Data Structure concepts such as Hashing Techniques and Optimal Binary Search Trees.

**QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

**REFERENCE BOOKS:**

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
2. Reema Thareja, Data Structures using C, 3<sup>rd</sup> Edition, Oxford press, 2012.

3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2<sup>nd</sup> Edition, McGraw Hill, 2013
4. A M Tenenbaum, Data Structures using C, PHI, 1989
5. Robert Kruse, Data Structures and Program Design in C, 2<sup>nd</sup> Edition, PHI, 1996.
6. Ashok N. Kamthane, Introduction to Data Structures in C, Pearson, 2010.
7. Venkatesh N.Baitipuli, Introduction to Data Structures using C, University Science Press, 1<sup>st</sup> Edition, 2009 .
  - **E-course link**
  - [https://onlinecourses.nptel.ac.in/noc21\\_ee39/preview](https://onlinecourses.nptel.ac.in/noc21_ee39/preview)

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b>			
As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
<b>III Semester, w.e.f 2023-24</b>			
<b>Operating System</b>			
<b>Course Code</b>	<b>22AM34</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number Lecture Hour/Week (L: T:P)</b>	<b>(2:1:0)</b>	<b>SEE Marks</b>	<b>50</b>
<b>Number of Lecture Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>
<b>Credits-03</b>			

<b>Course Objectives:</b> This course will enable students to
➤ Demonstrate the need for OS and different types of OS.
➤ Apply suitable techniques for the management of different resources
➤ Use processor, memory, storage and file system commands
➤ Analyze deadlock identification and prevention mechanisms, segmentation and paging techniques
➤ Study of paging techniques

MODULE NO.	TOPICS	TEACHING HOURS	RBT LEVELS
<b>1</b>	<p><b>Introduction to operating systems:</b> What operating systems do, Computer System organization, Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and Security, Distributed system, Special-purpose systems, Computing environments.</p> <p><b>System structures:</b> Operating System Services, User Operating System interface, System calls, Types of system calls, System programs, Operating system design and implementation, Operating System structure, Virtual machines, Operating System generation, System boot.</p>	<b>8</b>	<b>L1, L2, L3</b>
<b>2</b>	<p><b>Process Management:</b> Process concept, Process scheduling, Operations on processes, Inter process communication.</p> <p><b>Multi-threaded Programming:</b> Overview, Multithreading models, Thread Libraries, Threading issues.</p> <p><b>Process Scheduling:</b> Basic concepts, Scheduling Criteria, Scheduling Algorithms, Thread scheduling, Multiple-processor scheduling.</p>	<b>8</b>	<b>L1, L2, L3</b>
<b>3</b>	<p><b>Process Synchronization:</b> The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization.</p> <p><b>Deadlocks:</b> System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.</p>	<b>8</b>	<b>L1, L2, L3</b>

<b>4</b>	<p><b>Memory Management:</b> Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.</p> <p><b>Virtual Memory Management:</b> Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames.</p>	8	<b>L1, L2, L3</b>
<b>5</b>	<p><b>File System:</b> File concept, Access methods, Directory structure, File system mounting, File sharing.</p> <p><b>Implementing File system:</b> File system structure, File system implementation, Directory implementation, Allocation methods.</p> <p><b>Secondary Storage Structures:</b> Overview of Mass storage structures, Disk structure, Disk attachment, Disk scheduling.</p>	8	<b>L1, L2, L3</b>

**COURSE OUTCOMES:** At the end of the course the student will be able to:

<b>CO1</b>	Understand OS fundamentals, architecture, and operations.
<b>CO2</b>	Explore OS services, system calls, and structures.
<b>CO3</b>	Analyze process scheduling and inter-process communication.
<b>CO4</b>	Solve synchronization problems and handle deadlocks.
<b>CO5</b>	Learn memory allocation, paging, and virtual memory.
<b>CO6</b>	Design file systems and optimize storage access.

**QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Operating System Concepts, by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, Wiley India, 2012.

**REFERENCE BOOKS:**

1. Operating Systems, A Concept-Based Approach, by DM Dhamdhere, 3<sup>rd</sup> Edition, Tata Mcgraw-Hill, 2012.
2. Modern Operating Systems, by Andrew S. Tanenbaum and Herbert Bos, 4<sup>th</sup> Edition, Pearson, 2014.
3. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6<sup>th</sup> Edition
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3<sup>rd</sup> Ed, McGraw- Hill, 2013.
5. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4<sup>th</sup> Edition, PHI(EEE), 2014.
6. William Stallings Operating Systems: Internals and Design Principles, 6<sup>th</sup> Edition, Pearson.

### E-books and Online course materials

1. <https://deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/18cs43-os-module1.pdf>
2. <https://deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/18cs43-os-module1.pdf>  
[deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/module\\_2.pdf](https://deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/module_2.pdf)
3. [https://onlinecourses.nptel.ac.in/noc23\\_cs101/preview](https://onlinecourses.nptel.ac.in/noc23_cs101/preview).
4. <https://archive.nptel.ac.in/courses/106/105/106105214/>

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b>			
As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
<b>III Semester, w.e.f 2023-24</b>			
<b>Object Oriented Programming with Java</b>			
<b>Course Code</b>	<b>22AM35</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number Lecture Hour/Week (L:T:P)</b>	<b>2:1:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Number of Lecture Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>
<b>Credits-03</b>			

**Course Objectives:** This course will enable students to

- Learn the principles of object-oriented programming, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction.
- Gain a solid understanding of the basic syntax, data types, and control structures in Java, such as variables, data types, operators, selective and iterative statements.
- Learn how to handle exceptions and errors using try-catch blocks, and understand the concept of checked and unchecked exceptions.
- Grasp the fundamentals of multithreading and concurrency in Java, which allows for the execution of multiple tasks simultaneously.
- Organize related classes and interfaces into a hierarchical structure, promoting better code organization and maintainability.

MODUL E NO.	TOPICS	TEACHI NG HOURS	RBT LEVEL
1	<b>Introduction to Object Oriented Concepts:</b> Procedure-Oriented and Object Oriented Programming System, Principles of Object Oriented Programming, Differences between C , C++ and Java, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. <b>Class and Objects:</b> Introduction, member functions and data, objects and functions.	10	L1, L2, L3
2	<b>Introduction to Java:</b> Bytecode, Features of Java, Java Applications, Building and Running Java Program, Java Tokens, Data Types, Variables, Operators, Type Conversion and Casting, Arrays, Access Specifiers, Control Statements. <b>Java Classes:</b> Classes fundamentals, Declaring objects, Constructors, this keyword, garbage collection.	9	L1, L2, L3
3	<b>Inheritance &amp; Exception Handling:</b> Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception Handling: Exception handling in Java. <b>Packages &amp; Interfaces:</b> Defining Package, Access Protection, and Importing Packages; <b>Interfaces:</b> Defining and Implementing Interfaces, Nested Interfaces.	6	L1, L2, L3

4	<b>Exception Handling, Multithreading</b> <b>Exception Handling:</b> Exception Handling Fundamentals, Exception Types, Handling Exceptions using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally. <b>Multithreading:</b> Thread Creation, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread Communication: Producer-Consume Problem.	7	L1, L2, L3
5	<b>Applets, Java Input/Output</b> <b>Java Input/Output:</b> Stream classes, Byte Streams: InputStream, OutputStream, FileInputStream, FileOutputStream, PrintStream, DataInputStream, DataOutputStream; Character Streams: Reader, Writer, FileReader, FileWriter, PrintWriter. <b>Applets:</b> Applet basics, Applet Skeleton, Simple Applet Display Methods, Repaint method, Simple Banner Applet, HTML Applet Tag, Passing Parameters to Applet, getDocumentBase and getCodeBase methods, AppletContext Interface.	8	L1, L2, L3

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real-world problems.
CO4	Use the concept of multithreading, packages, and exception handling in solving the complex problem.
CO5	Apply concepts of applets in program development.

**QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill

**REFERENCE BOOKS:**

1. Mahesh Bhawe and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN:9788131720806.
2. Rajkumar Buyya, S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017.

## E-BOOKS AND ONLINE COURSE MATERIALS

1. <https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/>.
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs47/preview](https://onlinecourses.nptel.ac.in/noc22_cs47/preview).

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b> As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) <b>III Semester, w.e.f 2023-24</b>			
<b>SOFT SKILLS AND PERSONALITY DEVELOPMENT</b>			
<b>Course Code</b>	<b>22HSM310A</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number Lecture Hour/Week (L:T:P)</b>	<b>1:0:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Number of Lecture Hours</b>	<b>20</b>	<b>Exam Hours</b>	<b>03</b>
<b>CREDITS-01</b>			
<b>Course objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>• Enhance learners' soft skills by giving adequate exposure in the related subskills.</li> <li>• To acquaint the learners with moral values and its necessity.</li> <li>• Preparing the qualities that are important in the competitive era.</li> </ul>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>Module -1</b>			
<b>Introduction to Soft Skills and Hard Skills Personality Development:</b> Knowing Yourself, Positive Thinking, Johari's Window, Communication Skills, Non-verbal Communication, Physical Fitness <b>Emotional Intelligence:</b> Meaning and Definition, Need for Emotional Intelligence, Intelligence Quotient versus Emotional Intelligence Quotient, Components of Emotional Intelligence, Competencies of Emotional Intelligence, Skills to Develop Emotional Intelligence <b>RBT: L1, L2, L3</b>			4 Hours
<b>Module -2</b>			
<b>Academic Skills Employment Communication:</b> Introduction, Resume, Curriculum Vitae, Scannable Resume, Developing an Impressive Resume, Formats of Resume, Job Application or Cover Letter Professional Presentation: Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation Job Interviews: Introduction, Importance of Resume, Definition of Interview, Background Information, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips, Changes in the Interview Process, FAQ During Interviews Group Discussion: Introduction, Ambience/Seating Arrangement for Group Discussion, Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Types of Group Discussions, topic based and Case-based Group Discussion, Individual Traits. <b>RBT: L1, L2, L3</b>			4 Hours
<b>Module -3</b>			
<b>Communication Skills:</b> Art of Listening-Art of Speaking-Art of Reading-Art of Writing-Art of Writing E-mails: Email etiquette. <b>Professional Skills Creativity at Workplace:</b> Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method Ethical Values: Ethics and Society, Theories of Ethics, Correlation between Values and			4 Hours

Behaviour, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics. <b>RBT: L1, L2, L3</b>	
<b>Module-4</b>	
<b>Capacity Building:</b> Learn, Unlearn, and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building. <b>Corporate Skills:</b> Working with others- Developing proper body language-behavioral etiquette and mannerisms- Time Management –Stress Management. <b>RBT: L1, L2, L3</b>	4 4 Hours
<b>Module-5</b>	
<b>Leadership and Team Building:</b> Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends , Team Building, Types of Teams, Decision Making and Negotiation: Introduction to Decision Making, Steps for Decision Making, Decision-Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts <b>Job-hunting skills:</b> Writing Resume/CV- Interview skills -Group discussion -Mock interview Mock GD-Goal Setting-Career Planning. <b>RBT: L1, L2, L3</b>	4 Hours
<p><b>Course outcomes:</b> At the end of the course, the student will be able to:</p> <p>CO1: Develop self-awareness, emotional intelligence, and communication skills. CO2: Master resume writing, job applications, presentations, and interview techniques. CO3: Enhance communication, email etiquette, creativity, and workplace ethics. CO4: Learn adaptability, time management, stress management, and corporate etiquette. CO5: Build leadership, teamwork, decision-making, and job-hunting skills.</p>	
<p><b>Textbooks:</b></p> <p>1. Soft Skills: an Integrated Approach to Maximize Personality, Gajendra S. Chauhan, Sangeeta Sharma, Wiley India.</p> <p><b>Additional references:</b></p> <ol style="list-style-type: none"> <li>1. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press</li> <li>2. Business Communication, Shalini Kalia, Shailja Agrawal, Wiley India</li> <li>3. Soft Skills- Enhancing Employability, M. S. Rao, I. K. International</li> <li>4. Cornerstone: Developing Soft Skills, Sherfield, Pearson India</li> </ol> <ul style="list-style-type: none"> <li>• Development by Vikas Divyakirti"     Drishti IAS     - YouTube</li> <li>• <a href="https://onlinecourses.nptel.ac.in/noc19_hs32/preview">https://onlinecourses.nptel.ac.in/noc19_hs32/preview</a></li> <li>• (5967) How to Set Your Goal   Goal Setting in Your Life   Life Motivational Tips   Sonu Sharma - YouTube</li> </ul>	

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b>			
As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
<b>III Semester, w.e.f 2023-24</b>			
<b>Data Structures and Applications Lab</b>			
<b>Course Code</b>	<b>22AML36</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number of Lecture Hours/Week (L:T:P)</b>	<b>0:0:2</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Number of Lecture Hours</b>	<b>30</b>	<b>Exam Hours</b>	<b>3</b>
<b>CREDITS - 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>● Understand the fundamental data structures like arrays, linked lists, stacks, queues, trees, and graphs.</li> <li>● Understand various operations on Strings.</li> <li>● Design binary search tree and tree traversals.</li> <li>● Understand Hash Table functions.</li> </ul>			
<b>Implement the following problem statements using C in Windows/Linux operating system.</b>			
<b>Programs List:</b>			
1.	Develop a Program in C for the following: <ol style="list-style-type: none"> <li>a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String).</li> </ol> Write functions create(), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.		
2.	Develop a Program in C for the following operations on Strings. <ol style="list-style-type: none"> <li>a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)</li> <li>b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR</li> </ol> Support the program with functions for each of the above operations. Don't use Built-in functions.		
3.	Develop a menu driven Program in C for the following operations on STACK of Integers(Array Implementation of Stack with maximum size MAX) <ol style="list-style-type: none"> <li>a. Push an Element on to Stack</li> <li>b. Pop an Element from Stack</li> <li>c. Demonstrate how Stack can be used to check Palindrome</li> <li>d. Demonstrate Overflow and Underflow situations on Stack</li> <li>e. Display the status of Stack</li> <li>f. Exit</li> </ol> Support the program with appropriate functions for each of the above operations		
4.	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.		

5.	<p>Develop a Program in C for the following Stack Applications</p> <ol style="list-style-type: none"> <li>Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^</li> <li>Solving Tower of Hanoi problem with n disks</li> </ol>
6.	<p>Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)</p> <ol style="list-style-type: none"> <li>Insert an Element on to Circular QUEUE</li> <li>Delete an Element from Circular QUEUE</li> <li>Demonstrate Overflow and Underflow situations on Circular QUEUE</li> <li>Display the status of Circular QUEUE</li> <li>Exit</li> </ol> <p>Support the program with appropriate functions for each of the above operations</p>
7.	<p>Develop a menu driven Program in C for the following operations on Singly Linked List(SLL) of Student Data with the fields: <i>USN, Name, Programme, Sem, PhNo</i></p> <ol style="list-style-type: none"> <li>Create a SLL of N Students Data by using <i>front insertion</i>.</li> <li>Display the status of SLL and count the number of nodes in it</li> <li>Perform Insertion / Deletion at End of SLL</li> <li>Perform Insertion / Deletion at Front of SLL(Demonstration of stack)</li> </ol> <p>Exit</p>
8.	<p>Develop a menu driven Program in C for the following operations on Doubly Linked List(DLL) of Employee Data with the fields: <i>SSN, Name, Dept, Designation, Sal, PhNo</i></p> <ol style="list-style-type: none"> <li>Create a DLL of N Employees Data by using <i>end insertion</i>.</li> <li>Display the status of DLL and count the number of nodes in it</li> <li>Perform Insertion and Deletion at End of DLL</li> <li>Perform Insertion and Deletion at Front of DLL</li> <li>Demonstrate how this DLL can be used as Double Ended Queue.</li> </ol> <p>Exit</p>
9.	<p>Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> <li>Represent and Evaluate a Polynomial <math>P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3</math></li> <li>Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z)</li> </ol> <p>Support the program with appropriate functions for each of the above operations</p>
10.	<p>Develop a menu driven Program in C for the following operations on Binary Search Tree(BST) of Integers .</p> <ol style="list-style-type: none"> <li>Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2</li> <li>Traverse the BST in Inorder, Preorder and Post Order</li> <li>Search the BST for a given element (KEY) and report the appropriate message</li> </ol> <p>Exit</p>
11.	<p>Develop a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> <li>Create a Graph of N cities using Adjacency Matrix.</li> </ol> <p>Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method</p>
12.	<p>Given a File of N employee records with a set K of Keys (4-digit) which uniquely</p>

determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H:  
 $K \rightarrow L$  as  $H(K) = K \bmod m$  (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

**Course Outcomes:** After studying this course, students will be able to:

- CO1: Develop and demonstrate skills in handling structured data types using dynamic memory allocation.
- CO2: Apply stack and queue data structures to solve computational problems.
- CO3: Demonstrate the implementation and application of linked lists for dynamic data management.
- CO4: Construct and utilize binary search trees and graphs for efficient searching, traversal, and representation of data.
- CO5: Implement hashing techniques for file management and data retrieval.

**Suggested Learning Resources:**

- Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
- Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b> As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) <b>III Semester, w.e.f 2023-24</b>			
<b>OPERATING SYSTEM LAB</b>			
<b>Course Code</b>	<b>22AML37</b>	<b>CIE Marks</b>	50
<b>Number of Lecture Hours/Week (L:T:P)</b>	<b>0:0:2</b>	<b>SEE Marks</b>	50
<b>Total Number of Lecture Hours</b>	<b>30</b>	<b>Exam Hours</b>	3
<b>CREDITS - 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>• To Demonstrate the need of system calls and CPU Scheduling in OS</li> <li>• To discuss suitable techniques for producer-consumer and reader-writer problem.</li> <li>• To Analyze the various techniques for deadlock handling.</li> <li>• To demonstrate the need of Page Replacement algorithms and file management strategies.</li> <li>• To Simulate Disc Scheduling algorithms.</li> </ul>			
<b>Program List:</b>			
<b>Implement the following problem statements using Java in Windows/Linux operating system.</b>			
1.	Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)		
2.	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.		
3.	Develop a C program to simulate classical problems of synchronization i. Reader-Writer ii. Dining Philosophers		
4.	Develop a C program which demonstrates inter process communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.		
5.	Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.		
6.	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit      b) Best fit      c) First fit.		
7.	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU		
8.	Simulate following File Organization Techniques a) Single level directory b) Two level directory		
9.	Develop a C program to simulate the Linked file allocation strategies.		
10.	Develop a C program to simulate SCAN disk scheduling algorithm.		
<b>Course Outcomes:</b> After studying this course, students will be able to:			
CO1: Demonstrate process management and system calls for creating, terminating, and handling processes.			
CO2: Simulate CPU scheduling algorithms for efficient process management.CO3: Apply synchronization techniques to solve classical problems.			
CO4: Implement memory allocation and page replacement algorithms for effective resource management.			

CO5: Simulate file organization and disk scheduling techniques for storage management.

**Suggested Learning Resources:**

- Operating System Concepts, by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, Wiley India, 2012.

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b> As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) <b>III Semester, w.e.f 2023-24</b>			
<b>Object Oriented Programming with Java</b>			
<b>Lab</b>			
<b>Course Code</b>	<b>22AML38</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number of Lecture Hours/Week (L:T:P)</b>	<b>0:0:2</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Number of Lecture Hours</b>	<b>30</b>	<b>Exam Hours</b>	<b>3</b>
<b>CREDITS - 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>● Learn basics of JAVA programs and its execution.</li> <li>● Understand the principles of Object-oriented programming.</li> <li>● Understand the concept of exception handling mechanism.</li> <li>● Grasp the fundamentals of multithreading and concurrency in Java, which allows for the execution of multiple tasks simultaneously.</li> <li>● Understand life cycle of the applets and its functionality.</li> </ul>			
<b>Implement the following problem statements using Java in Windows/Linux operating system.</b>			
<b>Program List:</b>			
1.	(a) Write a Java program to implement class mechanism and create object to access the members of class. (b) Write a Java program to implement shift operators		
2.	(a) Write a Java program to illustrate Type Casting of the datatype and type conversion. (b) Write a Java program to iterate over Arrays using for Each loop to compute average of n natural numbers using Scanner class.		
3.	(a) Write a program in Java to demonstrate method overloading using iterative statements. (b) Write a program in Java to demonstrate constructor overloading using this keyword.		
4.	(a) Write a program in Java that implements multi-level inheritance. (b) Write a Java program to implement method overriding that shows use of super keyword.		
5.	(a) Write a Java program to illustrate Dynamic Method Dispatch using hierarchical inheritance. (b) Write a Java program for abstract class to find areas of different shapes.		
6.	Write a Java program that implements interface using extends keyword.		
7.	(a) Write a Java program that illustrates Exception handling mechanisms. (b) Write a Java program to illustrates break and continue statements.		
8.	Write a Java program that creates threads by extending Thread class.		

	<p>a. First thread display “Good Morning “every 1 sec,  b. Second thread displays “Hello “every 2 seconds  c. Third display “Welcome” every 3 seconds.</p>
9.	Write a Java program for Producer and Consumer Problem using Threads.
10.	<p>(a) Develop an applet that displays a simple message.  (b) Write a Java program to create a Banner using Applet.</p>
<b>Course Outcomes:</b> After studying this course, students will be able to:	
<p>CO1: Implement simple JAVA programs and its execution.  CO2: Apply object-oriented concepts such as classes, objects, inheritance, polymorphism, encapsulation, and abstraction.  CO3: Develop code that gracefully handles exceptions, preventing program crashes and providing meaningful error messages.  CO4: Create and manage threads in Java and understand the importance of synchronization in multithreaded programs.  CO5: Develop the simple Java applications using Applets.</p>	

**Suggested Learning Resources:**

- Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill
- E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

<b>B.Tech. in Artificial Intelligence &amp; Machine Learning (2022-Scheme)</b> As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) <b>III Semester, w.e.f 2023-24</b>			
<b>Unix and Shell Programming</b>			
Course Code	22AAM311A	CIE Marks	50
Number of Lecture Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Total Number of Lecture Hours	30	Exam Hours	03
Credits: 01			
Course Learning objectives: This course will enable students to:			
<ul style="list-style-type: none"> <li>● Study Unix basic commands.</li> <li>● Study of vi editor.</li> <li>● Understand the concepts of file handling commands.</li> <li>● To gain an understanding of important aspects related to the Shell programming.</li> </ul>			
Part A			
1.	<b>Basic Commands</b> <ol style="list-style-type: none"> <li>a. Use the <b>ls</b> command to list files in your home directory.</li> <li>b. Use the <b>pwd</b> command to print the current working directory.</li> <li>c. Use the <b>cd</b> command to navigate to different directories.</li> <li>d. Use the <b>mkdir</b> command to create a new directory.</li> </ol> Use the <b>touch</b> command to create an empty file.		
2.	<b>File Manipulation</b> <ol style="list-style-type: none"> <li>a. Create a file named "mytext.txt" and add some text to it using a text editor.</li> <li>b. Use the <b>cp</b> command to make a copy of "mytext.txt" with a different name.</li> <li>c. Use the <b>mv</b> command to rename the copied file.</li> <li>d. Use the <b>rm</b> command to delete a file.</li> </ol> Use the <b>cat</b> command to display the contents of a file.		
3.	<b>Text Processing</b> <ol style="list-style-type: none"> <li>a. Use the <b>echo</b> command to print a message to the terminal.</li> <li>b. Use the <b>grep</b> command to search for a specific word in a file.</li> <li>c. Use the <b>wc</b> command to count the number of lines, words, and characters in a file.</li> <li>d. Use the <b>sort</b> command to sort the lines of a file.</li> </ol> Use the <b>head and tail</b> commands to display the first and last few lines of a file.		
4.	<b>Permissions</b> <ol style="list-style-type: none"> <li>a. Use the <b>ls -l</b> command to view the permissions of files in a directory.</li> <li>b. Use the <b>chmod</b> command to change the permissions of a file.</li> </ol> Use the <b>chown</b> command to change the owner of a file.		
5.	<b>Variables</b> <ol style="list-style-type: none"> <li>a. Assign a value to a variable and use echo to display its content.</li> <li>b. Combine variables and text in a echo statement.</li> </ol> Experiment with different types of quotes (single, double) and understand their effects on variable interpolation.		

6.	<b>Scripting Basics</b> a. Write a simple script that prints a greeting message. b. Declare variables in a script and display their values. Use user input in a script to personalize the output.
7.	<b>Control Structures</b> a. Write a script that uses an if statement to check if a number is positive or negative. b. Use a for loop to print numbers from 1 to 5. Implement a while loop that counts down from 3 to 1
8.	<b>Command Substitution</b> a. Use command substitution to capture the output of a command and assign it to a variable. Incorporate command substitution into a script to dynamically obtain information.
9.	<b>Job Control</b> a. Use the <b>ps</b> command to list running processes. Use the <b>kill</b> command to terminate a specific process.
10.	<b>Environment Variables</b> a. Display the values of environment variables such as HOME, PATH, and USER. b. Experiment with modifying the value of an environment variable.
<b>Course Outcomes:</b> After studying this course, students will be able to: CO1: Become familiar with the Unix commands. CO2: Good knowledge of simple UNIX filters. CO3: Apply Changes in file system. CO4: Able to write simple programs using Shell scripts.	
<b>Suggested Learning Resources:</b> <ul style="list-style-type: none"> <li>• Unix Concepts &amp; Applications 4rth Edition, Sumitabha Das, Tata McGraw Hill</li> </ul>	
<b>E-resources:</b> <ul style="list-style-type: none"> <li>• <a href="https://www.tutorialspoint.com">https://www.tutorialspoint.com</a></li> <li>• <a href="https://www.w3schools.com">https://www.w3schools.com</a></li> </ul>	

**B.Tech. in Artificial Intelligence & Machine Learning (2022-Scheme)**  
As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
**III Semester, w.e.f 2023-24**

**Data Analytics with Excel**

<b>Course Code</b>	22AAM311B	<b>CIE Marks</b>	50
<b>Number of Lecture Hours/Week (L: T:P)</b>	0:0:2	<b>SEE Marks</b>	50
<b>Total Number of Lecture Hours</b>	32	<b>Exam Hours</b>	03

**Credit: 01**

**Course Learning objectives:** This course will enable students to:

- Apply analysis techniques to datasets in Excel.
- Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel.
- Understand and Identify the principles of data analysis.
- Become adept at using Excel functions and techniques for analysis.
- Build presentation ready dashboards in Excel.

1. **Getting Started with Excel:** Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2. **Working with Data :** Importing data, Data Entry & Manipulation, Sorting & Filtering.
3. **Working with Data:** Data Validation, Pivot Tables & Pivot Charts.
4. **Data Analysis Process:** Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5. **Cleaning Data with Text Functions:** use of UPPER and LOWER, TRIM function, Concatenate.
6. **Cleaning Data Containing Date and Time Values:** use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7. **Conditional Formatting:** formatting, parsing, and highlighting data in spreadsheets during data analysis.
8. **Working with Multiple Sheets:** work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9. **Create worksheet with following fields:** Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10. Generation of report & presentation using Autofilter & Macro.

**Course Outcomes:** After studying this course, students will be able to:

- Use advanced functions and productivity tools to assist in developing worksheets.
- Manipulate data lists using Outline and PivotTables.
- Use Consolidation to summarise and report results from multiple worksheets.
- Apply Macros and Autofilter to solve the given real world scenario.

**Suggested Learning Resources:**

1. <https://www.udemy.com/course/data-analytics-in-excel/>
2. [https://www.tutorialspoint.com/excel\\_data\\_analysis/excel\\_data\\_analysis\\_tutorial.pdf](https://www.tutorialspoint.com/excel_data_analysis/excel_data_analysis_tutorial.pdf)
3. <https://www.youtube.com/live/9AOHwmmq5ug?feature=shared>

Design & Analysis of Algorithms						
Course Code	22AM42				CIE Marks	50
Number Lecture Hour/Week	L	T	P	TOTAL	SEE Marks	50
	2	1	0	3		
Number of Lecture Hours	40				Exam Hours	03
Credits-03						

<b>Course Objectives:</b> This course will enable students to						
➤ Learn techniques for analyzing the efficiency of algorithms, including time and space complexity analysis.						
➤ Explore various algorithm design paradigms, such as divide and conquer, dynamic programming, and greedy algorithms and apply it solve the problems.						
➤ Develop the ability to make informed decisions about space-time trade-offs based on specific problem requirements and constraints.						
➤ Explore techniques for bounding the solution space to eliminate sub problems that cannot lead to an optimal solution.						
➤ Explore various techniques for transforming complex problems into simpler or more manageable forms.						

MODUL E NO.	TOPICS	TEACHING HOURS	RBT LEVEL
1	<b>Introduction:</b> Meaning and Properties of Algorithm, Fundamentals of Algorithm, Analysis Framework, Asymptotic Notations: Big-Oh notation (O), Omega notation ( $\Omega$ ), Theta notation ( $\Theta$ ) with examples, Mathematical analysis of non-Recursive and recursive Algorithms with Examples. <b>Brute Force Design Techniques :</b> Selection Sort, Bubble Sort, Sequential Search and Brute Force String Matching, Exhaustive Search, Advantages and Disadvantages of Brute force design.	8	L1,L2, L3
2	<b>Divide and Conquer:</b> General method, Recurrence equation for divide and conquer using Master's theorem, Merge sort, Quick sort, Binary search, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer. <b>Decrease and Conquer Approach:</b> Introduction, Insertion Sort, Depth-First Search and Breadth-First Search, Topological Sorting.	8	L1,L2, L3
3	<b>Space-Time Tradeoffs:</b> Introduction, Sorting by Counting, Input Enhancement in String Matching - Harspool's Algorithm . <b>Dynamic Programming:</b> Introduction, Transitive Closure - Warshall's Algorithm; All Pairs Shortest Paths - Floyd's Algorithm; Optimal Binary Search Tress, Knapsack Problem, Bellman Ford Algorithm, Travelling Sales Person Problem.	8	L1,L2, L3
4	<b>Transform and Conquer Approach:</b> Introduction, Heaps and Heap Sort. <b>Greedy Method:</b> Introduction, Coin Change Problem, Knapsack Problem, Job Sequence with Deadlines, Minimum Cost Spanning Trees - Prim's	8	L1,L2, L3

	Algorithm, Kruskal's Algorithm with performance analysis; Single Source Shortest Paths - Dijkstra's Algorithm; Optimal Tree Problem - Huffman Trees and Codes.		
<b>5</b>	<b>Backtracking:</b> General method, N-Queens Problem, Sum of Subset Problem, Hamiltonian Circuit Problem. <b>Branch and Bound:</b> Assignment Problem, Travelling Sales Person Problem, 0/1 Knapsack Problem. <b>NP-Complete and NP-Hard Problems:</b> P and NP Problems, NP-Complete Problems and NP-Hard Classes.	<b>8</b>	<b>L1,L2, L3</b>

**COURSE OUTCOMES:** At the end of the course the student will be able to:

<b>CO1</b>	Analyze the time and space complexity of algorithms using various notations and other complexity analysis techniques.
<b>CO2</b>	Design, implement and analyse various sorting and searching algorithms.
<b>CO3</b>	Design and analyze algorithms using dynamic programming and greedy strategies for optimization problems.
<b>CO4</b>	Evaluate and implement different branching strategies for selecting sub problems to explore, considering their impact on algorithm efficiency.
<b>CO5</b>	Represent the solution space as a state space tree, where nodes correspond to different states or decision points.

**QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

2. Introduction to the Design and Analysis of Algorithms, Anany Levitin;, 2nd Edition, 2009. Pearson.
3. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

**REFERENCE BOOKS:**

8. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
9. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).

DATABASE MANAGEMENT SYSTEM						
Course Code	22CS43				CIE Marks	50
Number Lecture Hour/Week	L	T	P	TOTAL	SEE Marks	50
	2	1	0	3		
Number of Lecture Hours	40				Exam Hours	03
<b>Credits-03</b>						

**Course Objectives:** This course will enable students to

- Provide a strong foundation in database concepts, technology, and practice
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems
- Learn techniques for generating reports from databases, including the use of SQL queries and reporting tools.

MODUL E NO.	TOPICS	TEACHING HOURS	RBT LEVEL
1	<p><b>Introduction to Databases:</b> Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.</p> <p><b>Overview of Database Languages and Architectures:</b> Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.</p> <p><b>Data Modeling using Entities and Relationships:</b> Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples.</p> <p><b>Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10</b></p>	8	L1,L2, L3
2	<p><b>Relational Model:</b> Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.</p> <p><b>Relational Algebra:</b> Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.</p> <p><b>Mapping Conceptual Design into a Logical Design:</b> Relational Database Design using ER-to-Relationalmapping.</p> <p><b>Textbook 1: Ch 5.1 to 5.3, 6.1 to 6.5, 7.1,</b></p>	8	L1,L2, L3
3	<p><b>SQL:</b> SQL data definition and datatypes, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. <b>Advances Queries</b> :More complex SQL retrieval queries, Specifying constraints as</p>	8	L1,L2, L3

	<p>assertions and action triggers, Views in SQL, Schema change statements in SQL.</p> <p><b>Database Application Development:</b> Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.</p> <p><b>Textbook 1: Ch 8.1, 8.2, 8.4, 8.6;</b></p> <p><b>Textbook 2: 6.1 to 6.5, 7.5 to 7.7</b></p>		
4	<p><b>Normalization:</b> Database Design Theory - Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.</p> <p><b>Normalization Algorithms:</b> Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms</p> <p><b>Textbook 1: Ch 14.1 to 14.7, 15.1 to 15.6</b></p>	8	L1, L2, L3
5	<p><b>Transaction Processing:</b> Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on serializability, Transaction support in SQL.</p> <p><b>Concurrency Control in Databases:</b> Two-phase locking techniques for Concurrency control, Concurrency control based on Time stamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.</p> <p><b>Textbook 1: Ch 17.1 to 17.6, 18.1 to 18.5, 19.1 to 19.7</b></p>	8	L1, L2, L3

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	To learn the fundamentals of data models and to represent a database system using ER Diagrams.
CO2	Develop application to interact with databases, relational algebra expression.
CO3	Use Structured Query Language (SQL) to demonstrate the basics of query evaluation and to have knowledge about database applications.
CO4	Understand and analyze the normal forms.

<b>CO5</b>	Design and build simple database systems and relate the concept of transaction, concurrency control and recovery in database.
------------	---

**QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

➤ **TEXT BOOKS:**

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

➤ **REFERENCE BOOKS:**

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 201

PYTHON APPLICATION PROGRAMMING			
Course Code	22CS44	CIE Marks	50
Number Lecture Hour/Week (L:T:P)	2:1:0	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
Credits-03			

<b>Course Objectives:</b> This course will enable students to
➤ Describe the semantics of Python programming language and illustrate the process of structuring the data using lists, dictionaries, tuples, strings and sets.
➤ Illustrate the Object-oriented Programming concepts in Python.
➤ Demonstrate the basic database design for storing data as part of a multi-step data gathering, analysis, and processing..
➤ Familiarize the basics of machine learning using an approachable, and also understand the advantage of using Python libraries for implementing Machine Learning models.

MODUL E NO.	TOPICS	TEACHING HOURS	RBTL VEL
1	<p><b>Python Basics:</b> Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program.</p> <p><b>Flow control:</b> Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().</p> <p><b>Functions:</b> def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number.</p> <p><b>Textbook 1: Chapters 1 - 3</b></p>	8	L1, L2
2	<p><b>Lists:</b> The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References.</p> <p><b>Dictionaries and Structuring Data:</b> The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.</p> <p><b>Manipulating Strings:</b> Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup</p> <p><b>Textbook 1: Chapters 4 - 6</b></p>	8	L1, L2, L3
3	<p><b>Pattern Matching with Regular Expressions:</b> Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting</p>	8	L1, L2, L3

	<p>Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor.</p> <p><b>Reading and Writing Files:</b> Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard.</p> <p><b>Organizing Files:</b> The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File.</p> <p><b>Textbook 1: Chapters 7 - 9</b></p>		
4	<p><b>Classes and objects:</b> Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying.</p> <p><b>Classes and functions:</b> Time, Pure functions, Modifiers, Prototyping versus planning.</p> <p><b>Classes and methods:</b> Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation.</p> <p><b>Inheritance:</b> Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation.</p> <p><b>Textbook 2: Chapters 15-18.</b></p>	8	L1, L2, L3
5	<p><b>Introduction to NumPy: Introduction, Array, NumPy Array, Indexing and slicing, Operations on Arrays, Concatenating Arrays, Reshaping Arrays, Splitting Arrays, Statistical operations on Arrays, Loading Arrays from files, saving NumPy Arrays in files on disk.</b></p> <p><b>Pandas and Data Visualization:</b> Introduction to Python Libraries, Series, DataFrame, Importing and exporting data between CSV Files and DataFrames, Pandas series Vs NumPy ndarray.</p>	8	L1, L2, L3

**TEXT BOOKS:**

1. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at <https://automatetheboringstuff.com/>) (Chapters 1 to 18)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist, 2nd Edition, Green Tea Press, 2015. (<http://greenteapress.com/thinkpython2/thinkpython2.pdf>) (Chapters 15, 16, 17) (Download pdf files from the above links).
3. Python Data Analytics: With Pandas, NumPy, and Matplotlib [Fabio Nelli](#), 2nd Edition, Apress, 2018
4. <https://numpy.org/doc/1.18/numpy-user.pdf>

<https://www.geeksforgeeks.org/pandas-built-in-data-visualization-ml/>

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	Demonstrate proficiency in handling of loops and creation of functions.
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.
CO3	Discover the commonly used operations involving regular expressions and file system.
CO4	Interpret the concepts of Object-Oriented Programming as used in Python..
CO5	Discuss the files, Pandas and Data visualization Concepts

**QUESTIONPAPERPATTERN:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four subquestions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**➤ TEXTBOOKS:**

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Halterman python
3. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

**➤ REFERENCEBOOKS:**

1. N. P. Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
2. B.V. Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.
4. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13:978-0815394372.

**ONLINE RESOURCES:**

1. <https://www.w3schools.com/python>
2. <https://docs.python.org/3/tutorial/index.html>
3. [https://www.python-course.eu/advanced\\_topics.php](https://www.python-course.eu/advanced_topics.php)

Fundamentals of Artificial Intelligence						
Course Code	22AM45			CIE Marks	50	
Number Lecture Hour/Week	L	T	P	TOTAL	SEE Marks	50
	2	1	0	3		
Number of Lecture Hours	40			Exam Hours	03	
Credits-03						

**Course Objectives:** This course will enable students to

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving.
- Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning.
- Explore methods for representing knowledge in AI systems.
- Define and understand the concept and architecture of expert systems.

MODULE NO.	TOPICS	TEACHING HOURS	RBT LEVELS
1	<p><b>Introduction to AI:</b> History, Intelligent systems, foundation and sub area of AI, applications, current trend and development of AI.</p> <p><b>Problem solving:</b> General problem solving, Characteristics of Problem, Exhaustive Searches-BFS,DFS, Heuristic Searches-General purpose Heuristic's, Generate and Test, Hill Climbing, Best first search, A* algorithm.</p> <p><b>Program 1:</b> Implement and Demonstrate Depth First Search Algorithm for Water Jug Problem</p>	8	L1,L2
2	<p><b>Problem reduction and Game playing :</b> Introduction, Problem reduction, game playing, Bounded look-ahead strategy and use of evaluation functions, alpha-beta pruning, Two player perfect information games</p> <p><b>Program 2:</b> Implement and Demonstrate the Game playing strategies for Tic-Tac-Toe game</p>	8	L1,L2
3	<p><b>Logic concepts and logic Programming:</b> Propositional calculus, Propositional logic, Natural deduction system, Axiomatic System, Semantic tableau system, Resolution refutation, Predicate logic-Predicate Calculus, First order Predicate Calculus, Logic programming.</p> <p><b>Program 3:</b> Implement and Demonstrate the Travelling Salesman Problem</p>	8	L1,L2

4	<b>Advanced problem solving paradigm: Planning:</b> Types of planning System, Block world problem, Logic based planning, Linear planning using a goal stack, Means-ends analysis, Nonlinear planning strategies-Goal set Method, Learning plans <b>Program 4:</b> Implement and Demonstrate Alpha-Beta Pruning	8	L1,L2
5	<b>Knowledge Representation, Expert system:</b> Approaches to knowledge representation, knowledge representation using semantic network, Extended semantic networks for KR, Knowledge representation using Frames. <b>Expert system:</b> Introduction phases, Expert System Architecture, Expert System verses Traditional system.	8	L1,L2

**COURSE OUTCOMES:** At the end of the course the student will be able to:

CO1	Identify and recognize AI techniques and describe their applications in daily life.
CO2	Understand different types of AI agents and how they work in a team to get more accurate results.
CO3	Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms).
CO4	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference, and theorem proving.
CO5	Apply knowledge representation, reasoning, and expert system to real-world problems.

➤ **QUESTION PAPER PATTERN:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

➤ **TEXT BOOKS:**

1. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014
2. Saroj Kaushik, "Artificial Intelligence" Cengage Publication, 2<sup>nd</sup> Edition, 2023.

➤ **REFERENCE BOOKS:**

1. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3. Stuart Russel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition, 2009.
4. George F Luger, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011.

➤ **JOURNALS/MAGAZINES:**

1. <https://opensky.ucar.edu/islandora/object/articles:21155>
2. [https://cs.cit.ie/contentfiles/PDFs/MScFlyers/MScAI\\_FT.pdf](https://cs.cit.ie/contentfiles/PDFs/MScFlyers/MScAI_FT.pdf)
3. <https://www.enterrasolutions.com/news/trends-predictions-2017-digital-transformation-2>
4. <https://www.wsj.com/articles/readers-beware-ai-has-learned-to-create-fake-news-stories-11571018640>

➤ **SWAYAM/NPTEL/MOOCs:**

1. <https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020-ec77ad13bdc1>
2. <https://javarevisited.blogspot.com/2020/08/top-10-coursera-courses-and-certification-for-artificial-intelligenceand-machine-learning.html#axzz6jQ05pXOG>.
3. <https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html>
4. <https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409>
5. <https://nptel.ac.in/courses/106/105/106105077/>

<b>Design &amp; Analysis of Algorithms Lab SEMESTER - IV</b>			
<b>Course Code</b>	22AML46	<b>CIE Marks</b>	50
<b>Number of Lecture Hours/Week</b>	02	<b>SEE Marks</b>	50
<b>Total Number of Lecture Hours</b>	30	<b>Exam Hours</b>	3
<b>CREDITS- 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>● Understand the various sorting algorithms.</li> <li>● Explore various algorithm design paradigms, such as divide and conquer, dynamic programming, and greedy algorithms and apply it solve the problems.</li> <li>● Explore techniques for bounding the solution space to eliminate sub problems that cannot lead to an optimal solution.</li> <li>● Find the most efficient way to connect all vertices in a graph while minimizing the total weight or cost of the edges.</li> </ul>			
<b>Implement the following problem statements using C / Java in Windows/Linux operating system.</b>			
<ol style="list-style-type: none"> <li>1. Design a program to search a key element of n integers using binary search algorithm and compute time complexity</li> <li>2. Design a program to Sort a given set of n integer elements using Quick Sort method and compute its time complexity.</li> <li>3. Design a program to sort set of n integer elements using Merge Sort method and compute its time complexity.</li> <li>4. Implement the 0/1 Knapsack problem using(a) Dynamic Programming method(b) Greedy method.</li> <li>5. Design a program to print all the node reachable from a given starting node in a given digraph using DFS method.</li> <li>6. Write a program to find the shortest paths from source vertex to other vertices using Dijkstra's algorithm.</li> <li>7. Write a program to find a Minimum Cost Spanning Tree of a given connected undirected graph using (a) Kruskal's algorithm (b) Prim's algorithm.</li> <li>8. Write a program to             <ol style="list-style-type: none"> <li>(a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.</li> <li>(b) Implement transitive closure using Warshall's Algorithm.</li> </ol> </li> <li>9. Implement a program to find a sum of subset problem.</li> <li>10. Implement Travelling Salesman problem using Dynamic programming.</li> </ol>			
<b>Course Outcomes:</b> After studying this course, students will be able to:			
CO1: Design and implement sorting and searching algorithms.			
CO2: Design and implement shortest path algorithms.			
CO3: Design and implement algorithms using dynamic programming and greedy strategies for optimization problems.			
CO4: Design and implement algorithms to find minimum spanning tree for the graph.			

**Conduct of Practical Examination:**

- Experiment distribution
  - a) For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - b) For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of  
The changed part only.
- Marks Distribution
  - i) For laboratories having only one part- Procedure+Execution +Viva-  
Voce:15+70+15=100 Marks
  - ii) For laboratories having PART A and PART B i. Part A-  
Procedure+Execution+Viva=6+28+6 =40 Marks ii. Part B- Procedure+Execution + Viva  
=9+42+9=60 Marks

**Suggested Learning Resources:**

- Introduction to the Design and Analysis of Algorithms, Anany Levitin;, 2nd Edition, 2009. Pearson.

<b>DATABASE MANAGEMENT LAB SEMESTER - IV</b>			
<b>Course Code</b>	22CSL47	<b>CIE Marks</b>	50
<b>Number of Lecture Hours/Week</b>	02	<b>SEE Marks</b>	50
<b>Total Number of Lecture Hours</b>	30	<b>Exam Hours</b>	3
<b>CREDITS- 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>● Provide a strong foundation in database concepts, technology, and practice</li> <li>● Practice SQL programming through a variety of database problems.</li> <li>● Provide skills in retrieving and manipulating data stored in databases using SQL queries.</li> <li>● Design and build database applications for real world problems</li> <li>● Learn techniques for generating reports from databases, including the use of SQL queries and reporting tools.</li> </ul>			
<p>1. Aim: Demonstrating creation of tables, applying the view concepts on the tables. Program: Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id, Programme_id, No-of_Copies) BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address) Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, 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.</p>			
<p>2. Aim: Discuss the various concepts on constraints and update operations. Program: Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to 1. Count the customers with grades above Bangalore’s average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don’t have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.</p>			
<p>3. Aim: Demonstrate the concepts of JOIN operations. Program: Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars) Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. List the titles of all movies directed by ‘Hitchcock’.</li> <li>2. Find the movie names where one or more actors acted in two or more movies.</li> <li>3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).</li> <li>4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.</li> <li>5. Update rating of all movies directed by ‘Steven Spielberg’ to 5.</li> </ol>			

4. Aim: Introduce concepts of PLSQL and usage on the table. Program: Consider the schema for College Database:

STUDENT(USN, SName, Address, Phone, Gender)  
SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID)  
COURSE(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 Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students

5. Aim: Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords. Program: Consider the schema for Company Database: EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS\_ON(SSN, PNo, Hours).

Write SQL queries to

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department
4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000.
6. Develop PL/SQL program using PROCEDURE.
7. Develop PL/SQL program using FUNCTIONS
8. Develop PL/SQL program using CURSOR.
9. Develop PL/SQL Programs using TRIGGERS.
10. Develop PL/SQL programs using PACKAGES

**Course Outcomes:** After studying this course, students will be able to:

CO1: Understand and apply MYSQL products for creating tables, views, indexes, sequences and other database objects

CO2: Design and implement a database schema for company database, banking database, ~~lay~~ information system, payroll processing system, student information system.

CO3: Design and implement simple and complex queries using DDL,

DML CO4: Implement PL/SQL blocks, procedure functions, packages and triggers

CO5: Demonstrate entity integrity, referential integrity, key constraints, and domain constraints on database

**Conduct of Practical Examination:**

- Experiment distribution
  - a) For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - b) For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of  
The changed part only.
- Marks Distribution
  - ii) For laboratories having only one part- Procedure+Execution +Viva-  
Voce:15+70+15=100 Marks
  - ii) For laboratories having PART A and PART B. Part A-  
Procedure+Execution+Viva=6+28+6 =40 Marks ii. Part B- Procedure+Execution + Viva  
=9+42+9=60 Marks

**Suggested Learning Resources:**

- Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
- Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

<b>ARTIFICIAL INTELLIGENCE LAB</b> (Effective from the academic year 2021-2022) <b>SEMESTER - IV</b>			
<b>Course Code</b>	22AML48	<b>CIE Marks</b>	50
<b>Number of Lecture Hours/Week</b>	02	<b>SEE Marks</b>	50
<b>Total Number of Lecture Hours</b>	30	<b>Exam Hours</b>	3
<b>CREDITS - 01</b>			
<b>Course Learning objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>Implement and evaluate AI algorithms in Python programming language.</li> </ul>			
<b>Programs List:</b>			
<b>Practicing Problems in Python( Students can be encouraged to practice good number of practice problems , some practice problems are listed here )</b>			
<b>PART - A</b>			
1	(a) Write a python program to print the multiplication table for the given number (b) Write a python program to check whether the given number is prime or not?(c) Write a python program to find factorial of the given number?		
2	(a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing) (b) Write a python program to implement List methods (Add, Append, and Extend & Delete).		
3	Write a python program to implement simple Chabot with minimum 10 conversations		
4	Write a python program to Illustrate Different Set Operations		
5	(a)Write a python program to implement a function that counts the number of times a string(s1) occurs in another string(s2).(b)Write a program to illustrate Dictionary operations([],in,traversal)and methods: keys(),values(),items()		
<b>PART - B</b>			
1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem		
2	Implement and Demonstrate Best First Search Algorithm on any AI problem		
3	Implement AO* Search algorithm.		
4	Solve 8-Queens Problem with suitable assumptions		
5	Implementation of TSP using heuristic approach		
6	Implementation of the problem-solving strategies: either using Forward Chaining or Backward Chaining		
7	Implement resolution principle on FOPL related problems		
8	Implement any Game and demonstrate the Game playing strategies		
<b>Course Outcomes:</b> After studying this course, students will be able to:			
CO1: Understand the basics of Python programming.			
CO2: Identification of Appropriate Algorithms for solving real-world Problems.			
CO3: Apply AI algorithms to real-world problems.			
CO4: Identify and Apply Artificial Intelligence concepts to solve real-world Problems			
<b>Conduct of Practical Examination:</b>			
<ul style="list-style-type: none"> <li>Experiment distribution           <ol style="list-style-type: none"> <li>For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.</li> <li>For laboratories having PART A and PART B: Students are allowed to pick one</li> </ol> </li> </ul>			

experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of

The changed part only.

- Marks Distribution

iii) For laboratories having only one part- Procedure+Execution +Viva-Voce:15+70+15=100 Marks

ii) For laboratories having PART A and PART B. Part A- Procedure+Execution+Viva=6+28+6 =40 Marks ii. Part B- Procedure+Execution + Viva =9+42+9=60 Marks

### **Suggested Learning Resources:**

- Reema Thareja, Python Programming: Using Problem Solving Approach, oxford university press 2nd edition.
- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at <http://greenteapress.com/thinkpython2/thinkpython2.pdf>) chapters 13, 15, 16, 17,18) (Download pdf/html files from the above links)

<b><u>UNIVERSAL HUMAN VALUES</u></b>			
[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Course Code	<b>22UHV410</b>	CIE Marks	50
Number Lecture Hour/Week	<b>2L+1T</b>	SEE Marks	50
Number of Lecture Hours	<b>40</b>	Exam Hours	03
<b>CREDITS-03</b>			
<b>Course Objectives:</b> Students will be taught to:			
1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.			
2. To facilitate the development to a Holistic perspective among students Towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.			
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.			
<b>Module-1</b>			<b>Teaching Hours</b>
<b>Introduction to Value Education: Lecture1:</b> Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) <b>Lecture2:</b> Understanding Value Education <b>Tutorial1: Practice Session PS1</b> Sharing about Oneself <b>Lecture3:</b> Self-explorations the Process for Value Education <b>Lecture4:</b> Continuous Happiness and Prosperity – the Basic Human Aspirations <b>Tutorial2: Practice Session PS2</b> Exploring Human Consciousness <b>Lecture5:</b> Happiness and Prosperity – Current Scenario <b>Lecture 6:</b> Method to Fulfill the Basic Human Aspirations <b>Tutorial3: Practice Session PS3</b> Exploring Natural Acceptance			<b>08Hours</b>
<b>Module-2</b>			

<p><b>Module2</b>–Harmony in the Human Being (6 lectures and 3 tutorials for practice session)</p> <p><b>Lecture7:</b> Understanding Human being as the Co-existence of the Self and the Body</p> <p><b>Lecture 8:</b> Distinguishing between the Needs of the Self and the Body</p> <p><b>Tutorial 4:</b> Practice Session PS4 Exploring the difference of Needs of Self and Body</p> <p><b>Lecture9:</b> The Body as an Instrument of the Self</p> <p><b>Lecture10:</b> Understanding Harmony in the Self</p> <p><b>Tutorial 5:</b> Practice Session PS5 Exploring Sources of Imagination in the Self</p> <p><b>Lecture 11:</b> Harmony of the Self with the Body</p> <p><b>Lecture12:</b> Programme to ensure self-regulation and Health</p> <p><b>Tutorial6:</b> Practice SessionPS6ExploringHarmonyofSelf with the Body</p>	<p><b>08Hours</b></p>
<p><b>Module-3</b></p>	
<p><b>Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)</b></p>	<p><b>08Hours</b></p>

<p><b>Lecture13:</b> Harmony in the Family–the Basic Unit of Human Interaction  <b>Lecture 14:</b> 'Trust' – the Foundational Value in Relationship  <b>Tutorial7:</b> Practice Session PS7 Exploring the Feeling of Trust  <b>Lecture 15:</b> 'Respect'- as the Right Evaluation  <b>Tutorial 8:</b> Practice Session PS8 Exploring the Feeling of Respect  <b>Lecture 16:</b> Other Feelings, Justice in Human-to-Human Relationship  <b>Lecture 17:</b> Understanding Harmony in the Society  <b>Lecture18:</b> Vision for the Universal Human Order</p>	
<b>Module-4</b>	
<p><b>Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)</b>  <b>Lecture19:</b> Understanding Harmony in the Nature  <b>Lecture20:</b> Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature  <b>Tutorial10: Practice Session PS10</b> Exploring the Four Orders of Nature  <b>Lecture21:</b> Realizing Existence as Co-existence at All Levels  <b>Lecture22:</b> The Holistic Perception of Harmony in Existence  <b>Tutorial11: Practice Session PS11</b> Exploring Co-existence in Existence</p>	<b>08Hours</b>
<b>Module-5</b>	
<p><b>Implications of the Holistic Understanding –a Look at Professional Ethics (6lectures and 3 tutorials for practice session)</b>  <b>Lecture 23: Natural Acceptance of Human Values</b>  <b>Lecture24:</b> Definitiveness of (Ethical) Human Conduct  <b>Tutorial 12: Practice Session PS12</b> Exploring Ethical Human Conduct  <b>Lecture25:</b> A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order  <b>Lecture26:</b> Competence in Professional Ethics  <b>Tutorial 13: Practice Session PS13</b> Exploring Humanistic Models in Education  <b>Lecture27:</b> Holistic Technologies, Production Systems and Management Models-Typical Case Studies  <b>Lecture 28:</b> Strategies for Transition towards Value-based Life and Profession  <b>Tutorial 14: Practice Session PS14</b> Exploring Steps of Transition towards Universal Human Order</p>	<b>08Hours</b>
<p><b>Course Outcomes:</b> After studying this course, students will be able to:  CO-1-Presentsustainable solutionstothe problems in society and nature  CO-2-See thatthesolutionsarepracticableanddrawroadmaps to achieve them.  CO-3-Grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment.  E.g. mutually enriching production system with rest of nature.  CO-4-Sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant.  CO-5-Makeuseoftheirunderstandinginthecourseforthehappyandprosperousfamilyandsociety.</p>	

**Text Books:**

1. The Textbook - A Foundation Course in Human Values and Professional Ethics, R R Gaur, RAsthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-53

**Reference Books:**

1. **Jeevan Vidya: v Ek Parichaya, ANagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.**
2. **Human Values, A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.**
3. **The Story of Stuff (Book).**
4. **The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi**
5. **Small is Beautiful- E. F Schumacher.**
6. **Slow is Beautiful- Cecile Andrews**
7. **Economy of Permanence -J C Kumarappa**

<b>SCRIPTING LANGUAGES</b>			
[As Per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme](Effective from the academic year 2022-2023)			
<b>SEMESTER - IV</b>			
<b>Subject Code</b>	<b>22ACS411B</b>	<b>CIE Marks</b>	<b>50</b>
<b>Number of Lecture Hours/Week</b>	<b>02</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Number of Lecture Hours</b>	<b>20</b>	<b>Exam Hours</b>	<b>03</b>
<b>Course objectives:</b> This course will enable students to:			
<ul style="list-style-type: none"> <li>● Use JavaScript for dynamic effects</li> <li>● To prepare PHP scripts</li> <li>● Use JavaScript &amp; PHP to validate form input entry</li> </ul>			
<b>No.</b>	<b>Title of the experiment</b>		
1.	Write a JavaScript to design a simple calculator to perform the following operations:sum, product, difference and quotient		
2.	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10andoutputs HTML text that displays the resulting values in an HTML table format.		
3.	Write JavaScript to validate the following fields of the Registration page. a. First Name (Name should contains alphabets and the length should not be less than6 characters). b. Password (Password should not be less than 6 characters length). c. E-mail id (should not contain any invalid and must follow the standard pattern <a href="mailto:name@domain.com">name@domain.com</a> ) d. Mobile Number (Phone number should contain 10 digits only).e.LastName and Address (should not be Empty).		
4.	Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits,alphabets and special characters		
5.	Write a JavaScript code that displays text "TEXT-GROWING" with increasing fontsize in theinterval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT- SHRINKING" in BLUE color. Then the font size decreases to 5pt.		
6.	a. Install and configure PHP, web server, MYSQL b. Write a program to print "Welcome to PHP" c. Write a simple PHP program using expressions and operators.		
7.	Develop and demonstrate PHP Script for the following problems: a) Write a PHP Script to find out the Sum of the Individual Digits. b) Write a PHP Script to check whether the given number is Palindrome or not		
8.	Write a PHP program to keep track of the number of visitors visiting the web page andtodisplay this count of visitors, with proper headings.		
9.	Write a PHP Program to display current Date, Time and Day.		

10.	Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix. c. Multiplication of two matrices. d. Addition of two matrices
11.	Write a PHP program named states.py that declares a variable states with value "MississippiAlabama Texas Massachusetts Kansas". write a PHP program that does the following: a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList. b. Search for a word in states that begins with k and ends in s. Perform a case insensitive comparison. Store this word in element 1 of statesList. c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list. d. Search for a word in states that ends in a. Store this word in element 3 of the list.
12.	Write a PHP program to sort the student records which are stored in the database using selection sort.
13.	Write a PHP program for sending and receiving plain text message (email).
<b>Course Outcomes:</b> After studying this course, students will be able to:	
CO1: Understanding the principle of Web design concepts CO2: Implementation of HTML in the workings of the web applications. CO3: Analysing and developing different types of web pages using HTML, CSS and JavaScript. CO4: Apply PHP built-in functions and custom functions for processing in web page design.	
Conduct of Practical Examination: • Experiment distribution j) For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity. k) For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity. • Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.	

• Marks Distribution

- i) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15  
= 100 Marks

For laboratories having PART A and PART B i. Part A – Procedure + Execution + Viva = 6 +28 + 6  
= 40 Marks ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

CO#	Course Outcomes
CO1	Understanding the principle of Web design concepts
CO2	Implementation of HTML in the workings of the web applications.
CO3	Analysing and developing different types of web pages using HTML, CSS and JavaScript.
CO4	Apply PHP built-in functions and custom functions for processing in web page design.