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Curriculum and Syllabus [Regulation-25]

Bachelor of Technology (B.Tech.) in Artificial Intelligence & Machine learning

(Effective From 2025-2026 Admission Batch)

Department of Computer Science and Engineering

Guru Nanak Institute of Technology

****NAAC 'A+' Accredited Autonomous Institute****
Affiliated to Maulana Abul Kalam Azad University of Technology
West Bengal
India

1st Year 1st Semester (Gr-A)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS101	Introduction to Programming and Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	PH101	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M101	Engineering Mathematics-I	3	0	0	3	3
4	HUM	Value Added Course	HU101	Environmental Science	2	0	0	2	2
5	HUM	Value Added Courses	HU102	Indian Knowledge System	1	0	0	1	1
B.PRACTICAL									
1	ENGG	Major	CS191	Introduction to Programming and Problem-Solving Lab	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	PH191	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	ME194	Engineering Graphics& Computer Aided DesignLab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU191	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
TotalofTheory,Practical								24	18

**HUM: Humanities; ENGG: Engineering; SCI: Science;*

1stYear2ndSemester (Gr-A)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				CreditPoints
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS201	Data structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
3	ENGG	Major	CS203	Digital Logic and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH201	EngineeringChemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	EngineeringMathematics–II	3	0	0	3	3
6	HUM	Value Added Course	HU202	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS291	Data structure & Algorithms Lab	0	0	3	3	1.5
2	ENGG	Minor	CS292	Introduction to Artificial Intelligence Lab	0	0	3	3	1.5
3.	ENGG	Major	CS293	Digital Logic and Computer Organization lab	0	0	3	3	1.5
4	SCI	Skill EnhancementCourse	CH291	EngineeringChemistryLab	0	0	2	2	1

5	ENGG	Skill EnhancementCourse	ME293	IDEA LAB Workshop	0	0	3	3	1.5
5									
C. MANDATORY ACTIVITIES / COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
TotalofTheory,Practical								**29**	**22**
TOTAL FIRST YEAR CREDIT									**40**

**HUM: Humanities; ENGG: Engineering; SCI: Science;*

2ND YEAR 3RDSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM301	**OPERATING SYSTEM**	3	0	0	3	3
2	ENGG	MAJOR	AM302	**DESIGN AND ANALYSIS OF ALGORITHM**	3	0	0	3	3
3	ENGG	MAJOR	AM303	**OBJECT ORIENTED PROGRAMMING**	3	0	0	3	3
4	SCI	MINOR	M(AM)301	**DISCRETE MATHEMATICS**	3	0	0	3	3
5	ENGG	MINOR	EC(AM)301	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING**	3	0	0	3	3
B. PRACTICAL									
1	ENGG	MAJOR	AM391	**OPERATING SYSTEM LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM392	**DESIGN AND ANALYSIS OF ALGORITHM LAB**	0	0	3	3	1.5
3	ENGG	MAJOR	AM393	**OBJECT ORIENTED PROGRAMMING LAB**	0	0	3	3	1.5
4	ENGG	SKILL ENHANCEMENT COURSE	AM394	**IT WORKSHOP (Sci LAB/ MATLAB/ PYTHON/ R)**	0	0	3	3	1.5
5	ENGG	MINOR	EC(AM)391	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB**	0	0	3	3	1.5
Total of Theory, Practical								**30**	**22.5**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

2ND YEAR 4THSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM401	**DATABASE MANAGEMENT SYSTEMS**	3	0	0	3	3
2	ENGG	MAJOR	AM402	**ADVANCED ARTIFICIAL INTELLIGENCE**	3	0	0	3	3
3	ENGG	MAJOR	AM403	**THEORY OF COMPUTATION**	3	0	0	3	3
4	SCI	MINOR	M(AM)401	**PROBABILITY AND STATISTICS**	3	0	0	3	3
5	HUM	ABILITY ENHANCEMENT COURSE	HU(AM)401	**PROJECT MANAGEMENT AND FINANCE**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM491	**DATABASE MANAGEMENT SYSTEMS LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM492	**ADVANCED ARTIFICIAL INTELLIGENCE LAB**	0	0	3	3	1.5
3	ENGG	SKILL ENHANCEMENT COURSE	AM493	**ADVANCED IT WORKSHOP (Sci LAB/ MATLAB/ PYTHON/ R)**	0	0	3	3	1.5
4	SCI	ABILITY ENHANCEMENT COURSE	HU(AM)491	**SOFT SKILL AND APTITUDE**	0	0	2	2	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM481	**RESEARCH METHODOLOGY& IPR**	1	2	0	3	2
Total of Theory, Practical									**22**
TOTAL SECOND YEAR CREDIT									**44.5**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

3RD YEAR 5THSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM501	**MACHINE LEARNING**	3	0	0	3	3
2	ENGG	MAJOR	AM502	**SOFTWARE ENGINEERING**	3	0	0	3	3
3	ENGG	MAJOR	AM503	**NATURAL LANGUAGE PROCESSING**	3	0	0	3	3
3	ENGG	MAJOR	AM504A	**CRYPTOGRAPHY & NETWORK SECURITY**	3	0	0	3	3
			AM504B	**INTERNET OF THINGS**					
			AM504C	**COMPUTER GRAPHICS**					
5	ENGG	MAJOR	AM505	**COMPUTER NETWORKS**	3	0	0	3	3
B. PRACTICAL									
1	ENGG	MAJOR	AM591	**MACHINE LEARNING LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM592	**SOFTWARE ENGINEERING LAB**	0	0	3	3	1.5
3	ENGG	MAJOR	AM593	**NATURAL LANGUAGE PROCESSING LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM581	**PROJECT- I**	0	0	2	2	2
2	ENGG	INTERNSHIP	AM582	**INDUSTRIAL INTERNSHIP**	0	0	2	2	1.5
Total of Theory, Practical								**27**	**23**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

3RD YEAR 6THSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM601	**NEURAL NETWORK AND DEEP LEARNING**	3	0	0	3	3
2	ENGG	MAJOR	AM602	**DIGITAL IMAGE PROCESSING**	3	0	0	3	3
3	ENGG	MAJOR	AM603	**CLOUD COMPUTING**	3	0	0	3	3
4	ENGG	MAJOR	AM604A	**MOBILE COMPUTING**	3	0	0	3	3
			AM604B	**QUANTUM COMPUTING**					
			AM604C	**PARALLEL COMPUTING**					
			AM604D	**DATA MINING AND DATA WAREHOUSING**					
5	HUM	MINOR	HU(AM)601	**CYBER LAW AND ETHICS**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM691	**NEURAL NETWORK AND DEEP LEARNING LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM692	**DIGITAL IMAGE PROCESSING LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM681	**PROJECT- II**	0	0	4	4	4
Total of Theory, Practical								**24**	**21**
TOTAL THIRD YEAR CREDIT									**43**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

4TH YEAR 7THSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM701	**WEB TECHNOLOGY**	3	0	0	3	3
2	ENGG	MAJOR	AM702A	**EVOLUTIONARY COMPUTING**	3	0	0	3	3
			AM702B	**COMPUTER VISION**					
			AM702C	**BIG DATA ANALYTICS**					
			AM702D	**INFORMATION THEORY AND CODING**					
3	ENGG	MAJOR	AM703A	**BLOCKCHAIN**	3	0	0	3	3
			AM703B	**BIOINFORMATICS**					
			AM703C	**ROBOTICS**					
			AM703D	**CYBER SECURITY**					
4	HUM	MINOR	HU(AM)701	**HUMAN RESOURCE DEVELOPMENT AND ORGANISATIONAL BEHAVIOUR**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM791	**WEB TECHNOLOGY LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM781	**PROJECT- III**	0	0	8	8	8
Total of Theory, Practical								**22**	**20.5**

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

4TH YEAR 8TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
C. SESSIONAL									
1	ENGG	MAJOR	AM881	**Grand Viva**	0	0	0	0	2
2	ENGG	PRJ	AM882	Internship/Entrepreneurship	0	0	0	10	10
Total of Theory, Practical								**10**	**12**
TOTAL FOURTH YEAR CREDIT									**32.5**

TOTAL CREDIT = 161

R25(AllB.Tech.)

Curriculum & Syllabus for B. Tech Under Autonomy Incorporation of NEP 2020

First Year Curriculum Structure (Effective from 2025-26 admission batch)

Group A: CSE, CSE (AIML), CST, DS, CS, CSE (IOT,CS,BCT), CSBS, FT, AGE, BME
Group B: ECE, EE, IT, ECS, CE, ME, AUE

1stYear1stSemester (Gr-A)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS101	Introduction to Programming and Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	PH101	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M101	Engineering Mathematics-I	3	0	0	3	3
4	HUM	Value Added Course	HU101	Environmental Science	2	0	0	2	2
5	HUM	Value Added Courses	HU102	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS191	Introduction to Programming and Problem-Solving Lab	0	0	3	3	1.5
2	SCI	SkillEnhancement Course	PH191	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	SkillEnhancement Course	ME194	Engineering Graphics& Computer Aided DesignLab	0	0	3	3	1.5
5	HUM	AbilityEnhancement Course	HU191	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
TotalofTheory,Practical								24	18

Course Title: Introduction to Programming and Problem Solving
Course Code: CS101
Contact Hours: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives

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

- Describe the architecture, memory systems, and evolution of computers.
- Convert between number systems and analyze binary arithmetic including IEEE754 representation.
- Construct algorithms and flowcharts for basic computational problems.
- Implement control structures, arrays, pointers, and functions in C programs.
- Demonstrate structured data types and file I/O using the C programming language.

Course Outcomes (COs):

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

CO1	Describe the architecture, memory hierarchy, and generations of computers, and classify hardware and software components, demonstrating a foundation of engineering knowledge required for understanding computing systems.
CO2	Convert values between number systems and analyze signed and IEEE754 floating-point representations, applying core concepts of mathematics and engineering fundamentals to solve complex engineering problems.
CO3	Construct flowcharts and algorithms for problem solving and develop modular programs in C using appropriate control logic, reflecting skills in design and development of solutions and modern tool usage.
CO4	Implement programs in C using control structures, arrays, pointers, and storage classes, and differentiate between memory management techniques, showcasing proficiency in problem analysis and engineering practice.
CO5	Demonstrate structured data types, file handling, and system-level I/O operations, and evaluate their effectiveness in ensuring data persistence and interfacing with hardware, promoting effective engineering tool usage and lifelong learning.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	2						2			
CO 2	2	2	3	3	3									
CO 3	2	3	2	2	2									
CO 4	3	2	2	3	3									
CO 5	2	2	2	1	1						2			

Course Content

Module 1: Basics of Computing & Number Representation (7L)

- History and generations of computers
- Classification: Digital, Analog, Hybrid, Micro, Mini, Mainframe
- Computer architecture: Input/Output units, Memory (Primary & Secondary), CPU
- Number systems: Binary, Octal, Decimal, Hexadecimal
- Conversions among number systems
- Signed number representations: 1's, 2's complement
- Floating point representation: IEEE 754 single & double precision
- ASCII codes
- Overview of compiler, interpreter, assembler

Module 2: Problem Solving & Introduction to C Programming (7 L)

- Algorithm, flowchart, and pseudocode

- Procedural vs Structured programming
- C basics: keywords, identifiers, variable naming (Hungarian Notation)
- Data types, constants, declaration, storage size, endianness
- Operators: Arithmetic, Logical, Relational, Bitwise, Conditional
- Operator precedence and type conversions
- Input/Output: scanf(), printf()

Module 3: Control Structures & Program Design (7 L)

- Control structures: if, if-else, switch, nested conditions
- Loops: while, for, do-while, break, continue
- goto and labels (with discussion on structured vs unstructured programming)
- Functions: declaration, definition, prototypes
- Parameter passing, return types, recursion
- Storage classes: auto, static, extern, register
- Preprocessor directives and macros

Module 4: Arrays, Pointers and Strings (8 L)

- Arrays: 1D & 2D, array to function passing
- Pointers: basics, pointer arithmetic, pointer to arrays
- Strings: character arrays, string library functions, array of strings
- Dynamic memory allocation: malloc(), calloc(), realloc(), free()

Module 5: Structured Data Types, File Handling & System Interface (7 L)

- Structures: definition, initialization, array of structures, pointers to structures
- Unions and enum, typedef, bit fields
- File I/O in C: fopen(), fclose(), fprintf(), fscanf(), fgetc(), fputc()

- Command line arguments

Textbook:

1. Schaum's Outline of Programming with C by Byron S. Gottfried, McGraw-Hill Education, 1st Edition (1996)
2. Let Us C by Yashavant Kanetkar, BPB Publications, 17th Edition
3. Computer Fundamentals by P.K. Sinha and Priti Sinha, BPB Publications,6th Edition

Reference Books:

1. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchiem, Prentice Hall, 2nd Edition
2. Fundamentals of Computers by V. Rajaraman and Neeharika Adabala, PHI Learning, 6th Edition
3. Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education, 10th Edition
4. Mastering C by K. R. Venugopal and S. R. Prasad, Tata McGraw-Hill Education, 2nd Edition
5. Programming in ANSI C by E. Balagurusamy, McGraw Hill Education 8th Edition

Course Name: Engineering Physics
Course Code: PH101
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objective(s):

The objective of the course is to make the students able to –

1. O1: **Provide foundational understanding** of core physical principles such as optics, quantum mechanics, solid-state physics, and statistical mechanics relevant to engineering disciplines.
2. O2: **Develop the ability** to apply theoretical knowledge of physical sciences in interpreting engineering phenomena and solving problems using scientific reasoning and quantitative analysis.
3. O3: **Expose students to the working principles** of modern devices and technologies like lasers, fiber optics, semiconductors, and nanomaterials used in engineering and industrial applications.
4. O4: **Encourage scientific curiosity and innovation** by connecting physical theories with practical tools and techniques in emerging fields like nanotechnology and quantum systems.
5. O5: **Understand the role of physics** in interdisciplinary domains for the advancement of science, technology, and sustainable development through real-life engineering contexts.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	*Explain* the principles of lasers, fibre optics, and holography and *apply* them in modern optical and communication systems.
CO2	*Identify* different crystal structures and *compute* structural parameters such as Miller indices and packing factors; *distinguish* between metals, semiconductors, and insulators using band theory.
CO3	*Utilize* the principles of quantum theory, wave-particle duality, and Schrödinger equation—to *interpret* fundamental quantum phenomena.
CO4	*Illustrate* the basic concepts of statistical mechanics and e*xamine* their implications on microscopic particle behaviour.
CO5	*Describe* the properties of nanomaterials and display/storage devices and *analyze* their applications in modern technology.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PSO 1**	**PSO 2**	**PSO 3**

CO 1	3								2		2			
CO 2	3	3							2		2			
CO 3	3	3							2		2			
CO 4	3	3							2		2			
CO 5	3	3							2		2			

Course Content:

Module 1: Modern Optics(11L)

1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and

equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 6L

1.02-Fibre Optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems.
3L

1.03--Holography Theory of holography (qualitative analysis), viewing of holography, applications.
2L

Module 2: Solid State Physics(5L)

2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.
3L

2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 2L

Module 3: Quantum and Statistical Mechanics (14L)

3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: Black body radiation, Photoelectric and Compton Effect: no derivation required), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems.
5L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement).
4L

3.03Statistical Mechanics

Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level-Qualitative discussion.
5L

Module 4: Physics of Nanomaterials (4L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5: Storage and display devices (2L)

Different storage and display devices-Magnetic storage materials, Operation and application of CRT, CRO, LED and OLED.

Text book:

1. Concepts of Modern Engineering Physics- A. S. Vasudeva. (S. Chand Publishers)

2. Engineering Physics - Rakesh Dogra

3. Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J.

Owens.

4. Quantum Mechanics – S. N. Ghosal

5. Nanotechnology – K. K. Chattopadhyay

Reference Books:

1. Optics - Ajay Ghatak (TMH)

2. Solid state Physics - S. O. Pillai

3. Quantum mechanics -A.K. Ghatak and S Lokenathan

4. Fundamental of Statistical Mechanics: B. B. Laud

6. Perspective & Concept of Modern Physics—Arthur Beiser

Course Name: Engineering Mathematics - I
Course Code: M101
Contact: (L:T:P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, coordinate geometry, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objective(s):

The objective of the course is to make the students able to –

1. Develop a strong foundation in both fundamental and advanced concepts of linear algebra and calculus essential for engineering applications.
2. Build competency in applying integration techniques in multiple dimensions, including line, surface, and volume integrals, to solve problems relevant to engineering and applied sciences.
3. Gain proficiency in analyzing multivariable functions using differentiation techniques such as partial and total derivatives, Jacobians, and methods for finding extrema.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply linear algebra methods to perform matrix operations, classify matrix structures, solve systems of linear equations, and compute eigenvalues and eigenvectors in engineering contexts.
CO2	Apply differential and integral calculus to evaluate and approximate the behavior of single-variable and multivariable real-valued functions relevant to engineering scenarios.
CO3	Analyze the properties of eigenvalues and eigenvectors to assess matrix diagonalizability and interpret linear transformations using the Cayley-Hamilton theorem in engineering systems.
CO4	Analyze single-variable and multivariable real-valued functions using differential and integral calculus to model and interpret complex behavior in engineering applications.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	1	-	-	-	-	-	-	2			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M101	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**			

Course Content:

Module I: Liner Algebra (11L)

Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Taylor's series.

Module III: Multivariable Calculus (Differentiation) (13L)

Function of several variables; Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function; Jacobian; Maxima and minima of functions of two variables.

Module IV: Multivariable Calculus (Integration) (7L)

Double Integral, Triple Integral; Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

1. Higher Engineering Mathematics, Grewal, B.S., Khanna Publishers, 36th Edition, 2010.

2. Advanced Engineering Mathematics, 9th Edition, Kreyszig, E., John Wiley & Sons, 2006.

Reference Books:

1. A text book of Engineering Mathematics-I, Guruprasad, S., New age International Publishers.
2. Higher Engineering Mathematics, Ramana, B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Engineering Mathematics for first year, Veerarajan, T., Tata McGraw-Hill, New Delhi, 2008.
4. A text book of Engineering Mathematics, Bali, N.P. and Goyal, M., Laxmi Publications, Reprint, 2008.
5. Calculus and Analytic geometry, 9th Edition, Thomas, G.B. and Finney, R.L., Pearson, Reprint, 2002.
6. Calculus, Volumes 1 and 2 (2nd Edition), Apostol, M., Wiley Eastern, 1980.
7. Linear Algebra - A Geometric approach, Kumaresan, S., Prentice Hall of India, 2000.
8. Linear Algebra: A Modern Introduction, 2nd Edition, Poole, D., Brooks/Cole, 2005.
9. Schaum's Outline of Matrix Operations, Bronson, R., 1988.
10. Differential and Integral Calculus, Vol. I & Vol. II, Piskunov, N., Mir Publishers, 1969.

Course Name: Environmental Science
Course Code: HU101
Contact Hours: L:2 T:0 P:0
Total Contact Hours: 24
Credits: 2

Prerequisites: 10+2

Course Objective(s)

1. 01 Realize the importance of environment and its resources.
2. 02 Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3. 03 Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4. 04 Solve scientific problem-solving related to air, water, land and noise pollution.

Course Outcome (COs)

After successful completion of the course, students will be able to

C01	Able to understand the natural environment and its relationships with human activities
C02	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk
C03	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

CO – PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	2	2	3	-	-	2	3	1	-	-	1
2	3	3	3	1	1	2	3	1	-	-	1
3	3	3	3	2	1	2	3	1	-	-	1
4	1	3	3	-	-	2	1	1	-	-	1

Module 1: Resources and Ecosystem (6L)

1. **Resources (4L)**

Types of resources, Human resource, Population Growth models: Exponential Growth, Logistic growth curve with explanation. Maximum Sustainable Yield [Derivation]

Alternative sources of Energy [Solar energy, tidal energy, geothermal energy, biomass energy]

2. Ecosystem (2L)

Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Pond eco system, Food chain, Food web.

Module 2: Environmental Degradation (10L)

1. **Air Pollution and its impact on Environment (3L)**

Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.

2. Water Pollution and its impact on Environment (4L)

Water Pollutants, Oxygen demanding wastes, heavy metals, BOD [Rate equation], COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal (As, Hg, Pb) poisoning and toxicity. Numerical on BOD, Hardness.

3. Land Pollution and its impact on Environment (1L)

Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes,

4. Noise Pollution and its impact on Environment (2L)

Types of noise, Noise frequency, Noise pressure, Measurement of noise level and decibel (dB) Noise intensity, Noise Threshold limit, Effect of noise pollution on human health. Numerical on Measurement of noise level and decibel (dB) and Noise Threshold limit.

Module 3 : Environmental Management (6L)

1. **Environmental Impact Assessment (1L)**

Environmental Auditing, Environmental laws and Protection Acts of India, carbon footprint, Green building practices. *(GRIHA norms)*

2. Pollution Control and Treatment (2L)

Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator.

WasteWater Treatment (Surface water treatment &Activated sludge process), Removal of hardness of water (Temporary &Permanent -Permutitprocess).

3. Waste Management (3L)

Solid waste management, Open dumping, Land filling, incineration, composting & Vermicomposting, E-waste management, and Biomedical Waste management.

Module 4 : Disaster Management (2L)

1. **Study of some important disasters (1L)**

Natural and Man-made disasters, earthquakes, floods drought, landslide, cyclones, volcanic eruptions, tsunami, oil spills, forest fires.

2. Disaster Management Techniques (1L)

Basic principles of disaster management, Disaster Management cycle, Disaster management policy, Awareness generation program

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT),

Gourkrishna Dasmohapatra, Vikas Publishing.

2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.

3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.

2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

Course Name: Indian Knowledge System
Course Code: HU102
Contact: 1:0:0
Total Contact Hours: 12
Credit: 01

Prerequisites: A basic knowledge (10+2 level) of Indian history, civilization and culture.

Course Objectives:

The objective of this course is to make the students able to—

O1: Understand the extent and aspects of ancient Indian cultural, philosophical and scientific heritage.

O2: Explore the philosophical roots of Indian knowledge, the scientific temper and quest for advanced understanding of the universe and deeper knowledge of the self.

O3: Identify and describe the Indian scientific and technological tools, techniques and discoveries and assess their significance and continuing relevance.

O4: Develop a liberality and open-mindedness of outlook to foster lifelong learning.

O5: Acquire the skills to apply traditional knowledge in their everyday lives.

Course outcome: After successful completion of the course, students will be able to

CO1	define, identify, describe and classify the philosophical, literary and socio-religious heritage of ancient India and the core concepts of the Vedic corpus and way of life.
CO 2	discover, enumerate, compare, contrast and categorize the importance of pioneering developments in science and mathematics and evaluate their continuing relevance.
CO 3	analyze, appraise, correlate and describe the ancient Indian heritage in science and technology and examine technological correlations with present-day technological applications.
C0 4	discover, assess and describe traditional knowledge in health care, architecture, agriculture and other sectors and to explore the history of traditional Indian art forms.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	1	2	-	3	-	3
CO2	2	-	1	-	-	2	-	-	3	-	3
CO3	3	1	1	1	2	3	-	-	3	-	3
CO4	2	-	1	-	2	3	-	-	3	-	3

Course Content:

Module-1 An overview of Indian Knowledge System (IKS):
(3L)

Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.

The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life.

Indian philosophical systems: Different schools of philosophy (Orthodox and Unorthodox).

Module-2 Salient features of the Indian numeral system:
(3L)

Developments in Indian Mathematics in ancient India - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers- Contribution of ancient Indian mathematicians

Highlights of Indian Astronomy: Historical development of astronomy in India- key contributions of ancient Indian astronomers.

Module-3 Indian science and technology heritage: (3L)

Metals and metalworking - Mining and ore extraction –Structural engineering and architecture in ancient India: planning, materials, construction and approaches- Dyes and painting; Shipbuilding.

Module-4 Traditional Knowledge in Different Sectors: (3L)

Traditional knowledge and engineering. Traditional Agricultural practices (resources, methods, technical aids); Traditional Medicine and Surgery; History of traditional Art forms and Culture.

Text Books:

1. Amit Jha . *Traditional Knowledge System in India*. New Delhi: Atlantic Publishers, 2024.

2. B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana . *Introduction to Indian Knowledge System: Concepts and Applications.* New Delhi: PHI, 2022.

3. Angad Godbole. *Science and Technology in Ancient India*. New Delhi: Biblia Implex, 2023.

4. Pritilakshmi Swain. *Indian Knowledge System*. New Delhi: Redshine Publication, 2024.

5. Vishnudut Purohit. *Fundamentals of Indian Knowledge System*. New Delhi: ABD Publishers, 2024.

Reference Books:

1. A. L. Basham. *The Wonder that was India*. Vol. I. New Delhi: Picador, 2019.

2. Arun Kumar Jha and Seema Sahay ed. *Aspects of Science and Technology in Ancient India.* Oxford and New Delhi: Taylor and Francis, 2023.

3.Kapil Kapoor and Awadhesh Kumar Singh. *Indian Knowledge Systems*. Vols. 1 and 2. New Delhi: D. K. Printworld, 2005.

4. S. N. Sen and K. S. Shukla, *History of Astronomy in India*. New Delhi: Indian National Science Academy, 2nd edition, 2000.

5. Arpit Srivastava. *Indian Knowledge System*. Rewa: AKS University, 2024.

Course Title: Introduction to Programming and Problem-Solving Lab
Course Code: CS191
Contact Hours: 0:0:3
Total Contact Hours: 36

Credits: 1.5

Course Objectives

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

- Understand the fundamentals of programming logic through algorithmic thinking.
- Implement and debug C programs using various control structures.
- Apply memory management concepts using pointers and arrays.
- Develop structured programs involving functions and recursion.
- Demonstrate file operations and manipulate data using structures and pointers.

Course Outcomes (COs)

After successful completion of the course, students will be able to

CO1	Identify fundamental programming constructs such as data types, operators, control structures, and apply them to solve basic computational problems.
CO2	Design modular programs using functions, arrays, and structures, and develop reusable solutions to solve real-world problems.
CO3	Demonstrate the use of pointers and dynamic memory management to analyze memory-efficient solutions for complex problems.
CO4	Construct file-based applications that enable persistent data storage and illustrate communication of results through formatted outputs.
CO5	Integrate multiple programming concepts to create a functional mini-project, demonstrating teamwork, project management skills, and adaptability to emerging challenges.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO	3	3			2						2			

1														
CO 2	2	2	3		3						2			
CO 3	2	3			3						2			
CO 4	2	2			3				2		2			
CO 5	2	3	2	2	3			3	2	2	3			

Course Content

Lab No.	Title / Experiment	Learning Focus
1	Introduction to C, Basic Input/Output, Data Types, and Operators	I/O operations, operator 1precedence, expressions
2	Problems on Conditionals: if, if-else, nested if, switch-case	Decision-making constructs
3	Looping Constructs: for, while, do-while	Iterative problem solving
4	Nested Loops: Pattern Printing, Series Problems	Logical structuring using loops
5	Functions: call by value, return types, recursion	Modular programming and recursion
6	Arrays: 1D and 2D array manipulation, search/sort problems	Data storage and iteration
7	Strings: string manipulation functions, array of strings	Character arrays and string operations
8	Pointers: pointer arithmetic, pointers with arrays and functions	Memory-level data access
9	Dynamic Memory Allocation using malloc(), calloc(), free()	Runtime memory management
10	Structures and Unions: defining, accessing, array of structures, pointer to structure.	Composite data types and access
11	File I/O: fopen(), fprintf(), fscanf(), fgetc(), fputc()	Persistent data storage

12	Mini Project: Combining structures, functions, and file I/O for a real-world scenario	Integration and application of concepts

Textbook:

1. Schaum's Outline of Programming with C by Byron S. Gottfried, McGraw-Hill Education, 1st Edition (1996)
2. Let Us C by Yashavant Kanetkar, BPB Publications, 17th Edition

Reference Books:

1. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchiem, Prentice Hall, 2nd Edition
2. Mastering C by K. R. Venugopal and S. R. Prasad, Tata McGraw-Hill Education, 2nd Edition
3. Programming in ANSI C by E. Balagurusamy, McGraw Hill Education 8th Edition

Course Name: Engineering Physics Lab
Course Code: PH191
Contact: (0:0:3)
Total Contact Hours: 36
Credit: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objective(s):

The objective of the course is to make the students able to –

1. O1: **Become familiar with scientific instruments and measurement techniques** used to determine various physical parameters of materials and systems.
2. O2: **Reinforce theoretical concepts learned in classroom physics** by performing related practical experiments and observing real-time outcomes.

3. O3: **Develop a systematic and analytical approach** to collecting, organizing, and interpreting experimental data for error analysis and validation of physical laws.
4. O4: **Engage in the experimental validation of physical laws** through laboratory activities involving classical mechanics, optics, electronics, and quantum phenomena.
5. O5: **Encourage innovation and problem-solving abilities** through hands-on investigation of advanced and application-oriented physics experiments, including specially designed extension activities.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	*Determine* mechanical properties such as Young's modulus and rigidity modulus through hands-on experiments and *analyze* material behaviour under applied forces.
CO2	*Perform* optical experiments including Newton's Rings, laser diffraction, and optical fiber characterization, and *interpret* the results based on wave optics principles.
CO3	*Investigate* quantum effects such as the photoelectric effect and atomic transitions, and *relate* experimental outcomes to basic quantum principles.
CO4	*Study* the performance of semiconductor and electronic devices like solar cells, LEDs, and LCR circuits, and *investigate* their operational characteristics.
CO5	*Conduct* experiments such as Hall Effect, e/m determination, prism dispersion, or optical rotation to *demonstrate* the application of advanced physical principles in practical scenarios.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3						3	2		2			
CO 2	3	3			3			3	2		2			
CO 3	3				3			3	2		2			
CO 4	3	3			3			3	2		2			
CO 5	3	3			3			3	2		2			

Course Content:

Module 1: General idea about Measurements and Errors (One Mandatory)

a. Error estimation using Slide callipers/ Screw-gauge/travelling microscope for one experiment.

Module 2: Experiments on Classical Physics (Any 4 to be performed from the following experiments)

1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.

Module 3: Experiments on Quantum Physics (Any 2 to be performed from the following experiments)

7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10.

a. Study of characteristics of solar cell (illumination, areal, spectral)

b. Study of characteristics of solar cell (I-V characteristics, Power-load characteristics, Power-wavelength characteristics)

Module 4: Perform at least one of the following experiments

11. Determination of Q factor using LCR Circuit.
12. Study of I-V characteristics of a LED/LDR.
13. Determination of band gap of a semiconductor.

**In addition, it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Module 5: Probable experiments beyond the syllabus

1. Determination of the specific charge of the electron (e/m) from the path of an electron beam by Thomson method.
2. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor3. Study of dispersive power of material of a prism.
3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Text book:

1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)

2. Practical Physics by K.G. Mazumder (New Central Publishing) 3. Practical Physics by R. K. Kar (Book & Allied Publisher)

Reference Books:

COURSE NAME: ENGINEERING GRAPHICS & COMPUTER AIDED DESIGN LAB
COURSE CODE: ME194
CONTACT: 0:0:3
CREDITS: 1.5
Prerequisites: Basic knowledge of geometry

Course Objectives:

The objective of the course is to teach detailed engineering drawing and modeling of a component or system for a given dimension or constraints through ample understanding of engineering views, projections and sections. It will help students to acquire the manual drawing techniques as well as computer aided graphics skills, using modern engineering tools to communicate their design effectively in industries.

Course Outcomes: Upon successful completion of this course, the student will be able to:

CO1: Use common drafting tools with the knowledge of drafting standards

CO2: Understand the concepts of engineering scales, projections, sections.

CO3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints

CO4: Produce part models; carry out assembly operation and represent a design project work.

CO-PO/PSO Mapping:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO1			3		2	1		2		1	
CO2			3		2	1		2		1	
CO3			3		3	1		2		2	
CO4			3		3	1		2		2	

Course Contents:

Basic Engineering Graphics: **3P**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing **6P**

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections **6P**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice- versa.

Module 3: Sections and Sectional Views of Right Angular Solids **6P**

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: **3P**

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics **3P**

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering **6P**

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project **3P**

Illustrating Geometry and topology of engineered components: creation of engineering models and tpresentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House

2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House

2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.

3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

Course Name: Communication and Presentation Skill
Course Code: HU191
Contact: (0:0:3)
Total Contact Hours: 36
Credit: 1.5

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: acquire interpersonal communication skills of listening comprehension and speaking in academic and professional situations.

O2: understand English pronunciation basics and remedy errors.

O3:operate with ease in reading and writing interface in global professional contexts.

O4:deliver professional presentations before a global audience.

O5:develop confidence as a competent communicator.

Course Outcome:

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

CO1	Recognize, identify and express advanced skills of Technical Communication in English and Soft Skills through Language Laboratory.
CO2	Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in

	societal and professional life.
CO3	Analyze, compare and adapt the skills necessary to be a competent interpersonal communicator in academic and global business environments.
CO4	Deconstruct, appraise and critique professional writing documents, models and templates.
CO5	Adapt, negotiate, facilitate and collaborate with communicative competence in presentations and work-specific conclaves and interactions in the professional context.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	1	2	3	-
CO2	-	2	-	-	-	2	-	-	-	3	-
CO3	-	-	-	-	-	2	-	-	3	3	-
CO4	-	2	-	-	-	-	-	3	-	3	-
CO5	-	-	-	-	-	3	-	-	3	3	-

Course Contents:

Module 1: Introduction Theories of Communication and Soft Skills

a. Communication and the Cyclic Process of Communication (Theory, benefits and application)

b. Introduction to Workplace Communication (Principles and Practice)

c. Non-Verbal communication and its application

c. Soft Skills Introduction: Soft-Skills Introduction

What is Soft Skills? Significance of Soft-Skills

Soft-Skills Vs. Hard Skills

Components of Soft Skills

Identifying and Exhibiting Soft-Skills (Through classroom activity)

Module 2: Active Listening

a. What is Active Listening?

b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking

c.Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening.

d. Listening in Business Telephony and Practice

Practical (Role plays, case studies)

Module 3: Speaking Skills

a. Effective Public Speaking: Public Speaking, Selecting the topic for public speaking, (Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, delivering the speech, Voice Clarity). Practical (Extempore)

Self Learning Topics: Preparation, Attire, Posture and Delivery techniques

b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation

c. Fluency-focused activities—JAM, Conversational Role Plays, Speaking using Picture/Audio

Visual inputs

d. Group Discussion: Principles, Do's and Don'ts and Practice;

Module 4: Writing and Reading Comprehension

a. Reading and Writing a Book Review (classroom activity)

b. Writing a Film Review after watching a short film (classroom activity)

c. Reading Strategies: active reading, note-taking, summarizing, and using visual aids like diagrams and graphs

d. Solving Company-Specific Verbal Aptitude papers.(Synonyms, Antonyms, Error Correction and RC Passages)

Module 5: Presentation Skills

Kinds of Presentation. Presentation techniques, planning the presentation,

Structure of presentation: Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management, Visual aids.

- Self Introduction, Creation of Video Resume`
- Need for expertise in oral presentation.·Assignment on Oral presentation.
- Rules of making micro presentation (power point). Assignment on micro presentation

Text Books:

1. Pushp Lata and Sanjay Kumar. *A Handbook of Group Discussions and Job Interviews*. New Delhi: PHI, 2009.

2. Jo Billingham. *Giving Presentations*. New Delhi: Oxford University Press, 2003.

3. B. Jean Naterop and Rod Revell. *Telephoning in English*. 3rd ed. Cambridge: Cambridge University Press, 2004.

4. Jeyaraj John Sekar. *English Pronunciation Skills: Theory and Praxis*. New Delhi: Authorspress, 2025.

5. Career Launcher. *IELTS Reading: A Step-by-Step Guide*. G. K. Publications. 2028

Reference Books:

1. Ann Baker. *Ship or Sheep? An Intermediate Pronunciation Course*. Cambridge: Cambridge University Press, 2006.

2. Barry Cusack and Sam McCarter. *Improve Your IELTS: Listening and Speaking Skills*. London: Macmillan, 2007.

3. Eric H. Glendinning and Beverly Holmström. *Study Reading*. Cambridge: Cambridge University Press, 2004.

4.Malcolm Goodale. *Professional Presentations*. New Delhi: Cambridge University Press, 2005.

5. Mark Hancock. *English Pronunciation in Use*. Cambridge: Cambridge University Press, 2003.

6. Tony Lynch, *Study Listening*. Cambridge: Cambridge University Press, 2004.

7. J. D. O'Connor. *Better English Pronunciation*. Cambridge: Cambridge University Press, 2005.

8. Peter Roach. *English Phonetics and Phonology: A Practical Course*. Cambridge: Cambridge University Press, 2000.

1stYear2ndSemester (Gr-A)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				CreditPoints
					L	T	P	Total	
C. THEORY									
1	ENGG	Major	CS201	Data structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
3	ENGG	Major	CS203	Digital Electronics and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH201	EngineeringChemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	EngineeringMathematics–II	3	0	0	3	3
6	HUM	Value Added Course	HU202	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B.PRACTICAL									
1	ENGG	Major	CS291	Data structure & Algorithms Lab	0	0	3	3	1.5
2	ENGG	Minor	CS292	Introduction to Artificial Intelligence Lab	0	0	3	3	1.5
3.	ENGG	Major	CS293	Digital Electronics and Computer Organization lab	0	0	3	3	1.5

4	SCI	Skill EnhancementCourse	CH291	EngineeringChemistryLab	0	0	2	2	1
5	ENGG	Skill EnhancementCourse	ME293	IDEA LAB Workshop	0	0	3	3	1.5
5									
C. MANDATORY ACTIVITIES / COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
TotalofTheory,Practical								**29**	**22**
TOTAL FIRST YEAR CREDIT									**40**

Course Name: Data Structures and Algorithms
Course Code: CS201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language

2. A solid background in mathematics, including probability, set theory.

Course Objective(s):

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

- Gain a strong foundation in data abstraction, data types, and data structures, and understand the importance of structured data organization in solving engineering problems.

- Formulate and analyze algorithms, perform asymptotic analysis using Big O, Θ (Theta), and Ω (Omega) notations, and comprehend the trade-offs between time and space complexities.

- Design and implement linear and non-linear data structures such as arrays, linked lists, stacks, queues, trees, heaps, and graphs, and apply them effectively in computational problem-solving.

- Evaluate and compare various searching, sorting, and hashing algorithms based on their performance, and choose appropriate methods for optimized data handling.

- Appreciate the role of data structures in real-world applications, foster a mindset of lifelong learning, and develop the adaptability to utilize modern programming tools and emerging technologies.

Course Outcomes (COs):

After successful completion of the course, students will be able to

CO1	Apply fundamental knowledge of data types, abstract data types, and data structures to analyze real-world computational problems and their memory/time constraints.
CO2	Design and implement linear data structures (arrays, linked lists, stacks, queues) using appropriate programming constructs to solve well-defined problems efficiently.
CO3	Develop recursive algorithms and simulate stack-based computations such as expression conversion and evaluation using appropriate engineering tools.
CO4	Construct and evaluate non-linear data structures (Binary Tree, BST, AVL Tree, heaps, graphs) and associated operations (search, insertion, deletion, traversal) to address complex engineering problems.
CO5	Compare and optimize sorting, searching, and hashing algorithms based on performance analysis and recognize their suitability in dynamic problem contexts to support life-long learning.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3												
CO 2	3	2	3		3									
CO 3	2	2	3		3									
CO 4	3	3	2	3	3									
CO 5	3	3			2						3			

Course Content:

Module 1: Introduction 4L

Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures.

Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Small Oh(o), Big Omega(Ω), Small Omega(ω) and Theta(Θ) notation (definition and significance).

Module 2: Non-Restricted Linear Data Structure 9L

List or Linear List: Definition and Example, List as ADT. Representation of Linear List- Sequential Representation and Linked Representation.

Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array- representation of polynomial using array, Representation of Sparse matrix using array.

Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.

Module 3: Restricted Linear Data Structure 6L

Stack: Definition of Stack, implementations of stack using array and linked list

Applications of stack- infix to postfix conversion, Postfix Evaluation

Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion.

Queue: Definition of Queue; Implementation of queue using array-physical, linear and circular model; Implementation of queue using linked list.

Dequeue - Definition and different types of dequeue.

Module 4: Nonlinear Data structures 9L

Trees and Binary Tree:

Basic terminologies; Definition of tree and binary tree. Difference between tree and binary tree, Representation of binary tree (using array and linked list)

Binary tree traversal (pre-, in-, post- order); Threaded binary tree- definition, insertion and deletion algorithm; Binary search tree- Definition, insertion, deletion, searching algorithm;

Height balanced binary tree: AVL tree- definition, insertion and deletion with examples only.

m –Way Search Tree: B Tree – Definition, insertion and deletion with examples only; B+ Tree – Definition, insertion and deletion with examples only.

Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm. Application of heap (priority queue and sorting).

Graphs: Definition and representation (adjacency matrix, incidence matrix and adjacency list).

Graph traversal– Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge).

Module 5: Sorting and Searching 8L

Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm (internal, external, stable, in-place, comparison based); Factors affecting sorting Methods, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort – algorithm with analysis (time complexity)

Searching: Factors affecting searching Methods; Sequential search –algorithm with analysis (time complexity); improvement using sentinel.

Binary search and Interpolation Search algorithm with analysis (time complexity)

Hashing: Introduction and purpose of Hashing and Hash functions (division, folding and mid-square), Collision resolution techniques.

Text book:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design in C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

Course Name: Introduction to Artificial Intelligence
Course Code: CS202
Contact: (L:T:P) 2: 0: 0
Total Contact Hours: 30
Credit: 2

Prerequisites:

Basic Computer Knowledge.

Course Objective(s):

The objective of the course is to make the students able to –

1. Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context.
2. Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.

3. Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.
4. Design AI-Frameworks for Inferencing based on knowledge base.
5. Analyse the effectiveness of AI-Inferencing Model in offering solutions to the respective problem.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand and explain** the fundamental concepts of **Knowledge Representation** and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing **Model/Agent** Design Framework within the scope of Artificial Intelligence paradigm.
CO3	**Explore** relevant literature and **apply** the concept of Heuristic Techniques of Artificial Intelligence to **solve** problems.
CO4	**Develop** Inferencing Models for **proposing** solutions to the problems of Artificial Intelligence.
CO5	**Implement** Inferencing Models of Artificial Intelligence through **developing** feasible algorithms and **investigate** their effectiveness by **analysing** their performances in solving the relevant problems.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO 3	2	2	3	2	-	-	-	-	-	-	-	2	-	2
CO 4	2	2	2	3	-	-	-	-	-	-	2	2	-	2
CO 5	2	2	3	3	2	-	-	-	-	-	2	2	2	3

Course Content:

Module 1: Introduction to Artificial Intelligence (3 Lectures)

Why AI • Definition of AI • Goals of AI • History and evolution of AI • Types of AI: Narrow, General, Super • Human vs Artificial Intelligence • Applications of AI in various domains • AI for social good

Module 2: Intelligent Agents and Logic-Based Thinking (8 Lectures)

Intelligent systems • Agents and environments • Decision making using rules and logic • Symbolic AI concepts • Propositional Logic: Knowledge Representation and Inference using Propositional Logic • Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module 3: Overview of AI Branches and Perception (8 Lectures)

Machine learning • Deep learning • Natural language processing • Computer vision • Expert systems • Fuzzy logic • Evolutionary algorithms • Reinforcement learning • Planning and scheduling • Human-AI collaboration

Module 4: Basics of Machine Learning (6 Lectures)

What is machine learning • AI vs ML • Types of learning: supervised, unsupervised • Concept of dataset, features, and labels • ML model and prediction flow • Common ML applications • Introduction to decision trees (concept only) • ML pipeline overview.

Module 5: Applications and Ethics of AI (5 Lectures)

AI in robotics and automation • AI-enabled smart applications • Industry 4.0 and intelligent systems • AI in different sectors: healthcare, agriculture, transport, education, etc. • Human-AI teamwork • Basics of AI ethics: bias, fairness, privacy • Career opportunities and future scopes in AI.

Text book:

AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), Saptarsi Goswami, Amit Kumar Das, Amlan Chakrabarti, Pearson.

Artificial Intelligence, Rich, E., Knight, K and Shankar, Tata McGraw Hill, 3rd Edition, B. 2009.

Artificial Intelligence - A Modern Approach, Russell, S. and Norvig, Prentice Hall, 3rd edition, P. 2015

Reference Books:

Artificial Intelligence: Beyond Classical AI, Reema Thareja, Pearson.

Introduction to Artificial Intelligence and Expert Systems, Patterson, Pearson.

Course Title: Digital Logic and Computer Organization
Course Code: CS203
Contact Hours: 3:0:0

Total Contact Hours: 36
Credits: 3

Course Objectives

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

- To introduce number systems, logic gates, and design of combinational and sequential circuits.
- To develop an understanding of data processing using micro-operations and instruction formats.
- To explain how CPU, memory, and I/O units are organized and interact during instruction execution.
- To describe arithmetic algorithms and control unit designs in processor architecture.
- To build a foundation for advanced topics like microprocessors, computer architecture, and embedded systems.

Course Outcomes (COs):

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

CO1	Explain various number systems and coding schemes, and apply Boolean algebra laws and Karnaugh Maps to simplify logical expressions.
CO2	Design and construct combinational and sequential logic circuits including adders, multiplexers, flip-flops, and counters for implementing digital functions.
CO3	Develop and analyze data path units such as ALU, control units, and register organizations to support instruction execution in CPU architectures.
CO4	Demonstrate arithmetic operations like Booth's multiplication and division, and illustrate various addressing modes and instruction formats used in CPUs.
CO5	Compare memory hierarchy systems and I/O techniques, and evaluate their role in enhancing overall processor performance.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO	3	3			2									

1														
CO 2	3	3	3		3									
CO 3	3	2			3									
CO 4	3	2			2									
CO 5	3	2			2					2	3			

Course Content

Module 1: Number Systems, Boolean Algebra, and Logic Simplification (6 L)

- Binary, BCD, ASCII, EBCDIC, Gray Code & conversions [1L]
- Boolean Algebra – Laws, Theorems [1L]
- Boolean Functions, Minterm& Maxterm, SOP & POS Forms [2L]
- Karnaugh Map (up to 4-variable), Algebraic Simplification [2L]

Module 2: Combinational Circuits (6 L)

- Half & Full Adder/Subtractor, Serial & Parallel Adders, CLA Adder [2L]
- Parity Generator, Encoder, Decoder, Multiplexer, Demultiplexer [2L]
- Comparator, Code Converters [2L]

Module 3: Sequential Circuits & Registers (6 L)

- Flip-Flops: SR, JK, Master-Slave JK, D, T; Characteristic & Excitation Tables [2L]
- Counters: Synchronous/Asynchronous, Ring & Johnson, Mod-N Counters [2L]
- Registers: SISO, SIPO, PIPO, PISO [1L]

- Applications of Counters and Registers [1L]

Module 4: Data Representation & Arithmetic Operations (5 L)

- Integer Arithmetic (Add, Subtract), Booth's Multiplication Algorithm [2L]
- Restoring & Non-Restoring Division [1L]
- Instruction Formats and Addressing Modes [2L]

Module 5: CPU and Control Unit Organization (6 L)

- Register Transfer Language (RTL), Bus Architecture, Micro-operations [1L]
- ALU Design, Status Flags, General Register & Stack Organization [2L]
- Control Unit: Hardwired vs. Microprogrammed Control, Sequencing [2L]
- Basic Instruction Cycle and Execution Pipeline [1L]

Module 6: Memory & I/O Organization (7 L)

- RAM, ROM Types, Memory Hierarchy: Cache, Main, Secondary [1L]
- Cache Mapping: Direct, Associative, Set-Associative; Write Policies [3L]
- Virtual Memory: Paging, Segmentation, FIFO & LRU [1L]
- I/O Transfer Modes: Programmed I/O, Interrupt-Driven I/O, DMA [1L]
- Interrupts: Maskable/Non-Maskable, Daisy Chaining; I/O Processor [1L]

Textbooks:

1. Digital Logic and Computer Design by M. Morris Mano, Pearson Education, 1st Edition
2. Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education, 10th Edition

Reference Books:

1. Digital Design by M. Morris Mano, Michael D. Ciletti, Pearson Education, 5th Edition
2. Computer Organization and Embedded Systems By Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw-Hill Education, 6th Edition
3. Computer Organization and Design: The Hardware/Software Interface By David A. Patterson, John L. Hennessy, Morgan Kaufmann Publishers, RISC-V Edition
4. Fundamentals of Logic Design by Charles H. Roth Jr., Larry L. Kinney, Cengage Learning, 7th Edition
5. Digital Fundamentals by*Thomas L. Floyd*, Pearson Education, 11th Edition

Course Name: ENGINEERING CHEMISTRY
Course Code: CH201
Contact Hours: L:2 T:0 P:0
Total Contact Hours: 24
Credit: 2
Prerequisites: 10+2

Course Objective(s)

1. 01 Understand the basic principles of atomic structures and periodic properties of elements,different engineering materials, advanced polymers.
2. 02 Apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.
3. 03 Apply the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.
4. 04 Analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.
5. 05 Evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices

Course Outcome (COs)

After successful completion of the course, students will be able to

CO1	Understand the basic principles of atomic structures and periodic properties of elements, different engineering materials, advanced polymers.
CO2	Apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.
CO3	Utilize the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.
CO4	Analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.
CO5	Evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices

CO-PO mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**3**	-	-	-	-	-	-	-	-	-	-
CO2	**3**	-	-	-	-	-	-	-	**2**	-	**2**
CO3	**3**	-	-	-	-	-	-	-	**2**	-	**2**
CO4	**3**	**3**	-	-	-	-	-	-	**2**	-	**2**
CO5	**3**	**3**	**3**	-	-	-	-	-	**2**	-	**2**

COURSE CONTENT

Module 1 (6 L)

QuantumProperties of Atoms (4 L)

Schrodinger Wave Equation (time independent – basic principles only), de Broglie Equation, Heisenberg Uncertainty Principle, Quantum Numbers, Effective nuclear charge, Slater's rule, penetration of orbitals, variations of orbital energies in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, oxidation properties.

Chemistry of materials (2L)

Semiconductor-Based Memory Materials (Si & Ge) [Introduction, Properties and role of Si & Ge), Intensive & Extensive semiconductor,

Module 2 (7 L)

Chemical Thermodynamics (5L)

1st & 2nd Law of Thermodynamics, Tendency for maximum randomness, Carnot Heat Engine [Derivation], Entropy characteristics, Mathematical explanation & physical significance of Entropy, Entropy change of ideal gas for isothermal reversible process, Gibbs free Energy Function, Standard free Energy, Criterion of spontaneity.

Electricity production through chemical reactions (2L)

Electrochemical Cell, writing of cell notation, free energy and EMF, Criterion of spontaneity in terms of Cell,

Nernst equation (only expression, no derivation) and applications, calculation of EMF of a cell, calculation of single electrode potential, calculation of Kc, calculation of Kc from G^0.

Working principle and applications of Lithium-ion batteries

Module 3 (6L)

Polymers for Engineering Applications (3L)

Polymers and their classifications (based on origin, chemical structure, polymeric structure, tacticity and molecular forces)

Commercially important polymers: Synthesis and applications of Bakelite, nylon 6,6, HDPE & LDPE

Conducting polymers –Types examples and applications.

Biodegradable polymers –definition, example and uses

Industrial Chemistry (3L)

Types of corrosion, Electrochemical theory of corrosion, rusting of iron, comparison of chemical & electrochemical corrosion. [Mechanism excluded]

Factors affecting the rate of corrosion; nature of metal (physical state, purity, position in Galvanic series) & environment.

Corrosion control: Cathodic protection, anodic protection, Inorganic coatings.

Classification of Fuel (LPG, CNG, BIOGAS), Calorific value, Octane number, Cetane number, HCV, LCV. [Definition only]

Module 4 (5 L)

Organic Reactions & synthesis of drugs (3L)

Acidity and basicity comparison of organic compounds(acids, alcohols & amines), Nucleophilic Substitution reaction and Electrophilic Addition reactions, Markonikov's rule, peroxide effect, Synthesis of Paracetamol& Aspirin and uses.(Name reactions are not in syllabus)

Spectroscopy (2L)

Electromagnetic spectrum, Lambert-Beer Law, Finding of λ max value & concentration of the unknown solution, Applications of UV-VIS spectroscopy, Chromophores & Auxochromes.

Applications of IR spectroscopy, Fingerprint region

Text Books

- Chemistry –I, Gourkrishna Das Mohapatro
- A text book of Engineering Chemistry, Dr. Rajshree Khare
- Engineering Chemistry, U. N. Dhar
- Physical Chemistry, P.C. Rakshit

Reference Books

- Engineering Chemistry, Jain & Jain
- Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishna
- Text book of Engineering Chemistry, Jaya Shree Anireddy

Course Name: Engineering Mathematics - II
Course Code: M201
Contact: (L:T:P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, coordinate geometry, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objective(s):

The objective of the course is to make the students able to –

1. Develop a thorough understanding of ordinary differential equations and their role in modeling real-world systems.
2. Build competency in applying the Laplace transform as a tool for solving initial value problems and linear differential equations in engineering contexts.
3. Gain proficiency in numerical techniques for solving mathematical problems where analytical methods are difficult or impossible.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply analytical methods to solve ordinary differential equations in engineering contexts.
CO2	Apply the properties and inverse of Laplace Transforms to compute improper integrals and determine solutions of linear ordinary differential equations with constant coefficients in engineering scenarios.
CO3	Apply numerical methods to interpolate data, perform numerical integration, and solve ordinary differential equations in engineering applications.
CO4	Analyze the behavior of solutions using analytical and numerical approaches, including Laplace transforms, to assess stability, convergence, and accuracy in engineering contexts.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	2	-	-	-	-	-	-	-	-	1			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M201	**3**	**2.25**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.25**			

Course Content:

Module I: First Order Ordinary Differential Equations (ODE) (9L)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation.

Solution of first order and higher degree ODE: solvable forp, solvable for y and solvable for xand Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) (8L)

Solution of second order ODE with constant coefficients: Complementary Function and Particular Integral, Method of variation of parameters, Cauchy-Euler equations.

Module III: Laplace Transform (LT) (12L)

Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of tf(t), LT of f(t)t, LT of derivatives of f(t), LT of integral of f(t), Evaluation of improperintegrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties,Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution oflinear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation. **Numerical integration:** Trapezoidal rule, Simpson's 1/3 Rule. **Numerical solution of ordinary differential equation:** Euler method, Fourth order Runge-Kutta method.

Text Books:

1. Higher Engineering Mathematics, Grewal, B.S., Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, 9th Edition, Kreyszig, E., John Wiley & Sons, 2006.

Reference Books:

1. A text book of Engineering Mathematics-I, Guruprasad, S. New age International Publishers.
2. Higher Engineering Mathematics, Ramana, B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Engineering Mathematics for first year, Veerarajan, T., Tata McGraw-Hill, New Delhi, 2008.
4. A text book of Engineering Mathematics, Bali, N.P. and Goyal, M., Laxmi Publications, Reprint, 2008.
5. Calculus and Analytic geometry, 9th Edition, Thomas, G.B. and Finney, R.L., Pearson, Reprint, 2002.
6. Calculus, Volumes 1 and 2 (2nd Edition), Apostol, M., Wiley Eastern, 1980.
7. Linear Algebra - A Geometric approach, Kumaresan, S., Prentice Hall of India, 2000.

8. Linear Algebra: A Modern Introduction, 2nd Edition, Poole, D., Brooks/Cole, 2005.
9. Schaum's Outline of Matrix Operations, Bronson, R., 1988.
10. Differential and Integral Calculus, Vol. I & Vol. II, Piskunov, N., Mir Publishers, 1969.

Course Name: ***Constitution of India and Professional Ethics***
Course Code: HU202
Contact: 1:0:0
Total Contact Hours: 12
Credit: 1
Prerequisites:

A basic knowledge (10+2 level) of the Indian Constitution and moral science.

Course Objectives: The objectives of this course are to make the student able to-

O1: understand the salient features of the Indian constitution and form of government.

O2: develop ethical awareness and responsible professional conduct.

O3:understand ethical frameworks, guidelines and recognize ethical dilemmas.

O4:understand professional responsibilities and applications of ethical principles in real-life scenarios.

O5: develop an awareness of the social impact of the profession and act responsibly in the broader community.

Course outcome: After successful completion of this course, students will be able to

CO1	Identify, define and understand the significance of the Constitution of India, its spirit and values and the fundamental rights and duties as a responsible citizen.
CO2	define and discover core ethical concepts, the basic perception of profession, and professional ethics that shape the ethical behavior of an engineer.

CO3	identify, examine and apply codes of engineering ethics, engineers' social responsibilities and industrial standards and ethical dilemmas.
CO4	consider, correlate and appraise ethical leadership and principles in addressing gender issues, concerns of IPR and industrial responsibilities.

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO 1	-	-	-	-	-	-	-	**2**	-	-	**2**
CO 2	-	-	-	-	-	-	**3**	**2**	-	-	**2**
CO 3	-	-	-	-	-	**2**	**3**	**2**	-	-	**2**
CO 4	-	-	-	-	-	**2**	**3**	**3**	-	-	**2**

Course Contents:

Module 1: Introduction to the Constitution of India and Indian Government: (2L)

Preamble : Salient Features, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliament -Powers and Functions –Executive- President -Governor - Council of Ministers.

Module 2: Professional Ethics and Human Values: (3L)

Introduction to Ethical Thinking; what is Ethics, Work ethics; Scope of Professional Ethics, Values and Characteristics, Types of values: Negative and positive values, Ethical values for Professional success.

Module 3: Codes of Professional Ethics, Violation and Safeguards: (4L)

Engineering Ethics, Ethical theories: a brief overview; utilitarianism, deontology, virtue ethics.

Professional Codes, Codes of professional ethics-Moral dilemmas, and moral autonomy- Internal ethics of business: whistle blowing, conflicts of interest, Job discrimination, and Exploitation of Employees; Social and ethical responsibilities of technologists: Responsibilities towards Customers, shareholders, employees – Social Audit.

Case Studies: Bhopal Gas Tragedy, Chernobyl (linking ethics to real-world failures).

Module 4: Business Ethics and Workplace Issues: (3L)

Business ethics, ethical decision-making frameworks - Impact of ethics on business policies and strategies- Characteristics of ethical leaders; fostering integrity in teams; Addressing occupational crime, discrimination, and gender-based issues in workplaces-Intellectual property rights (IPR), Plagiarism and Academic Misconduct.

Text Books:

1.Durga Das Basu. *Introduction to the Constitution of India*. 27th ed. New Delhi: Lexis Nexis, 2024.

2. R.S Naagarazan. *A Textbook on Professional Ethics and Human Values*. New Age International (P) Limited, 2022.

3. N. Subramanian. *Professional Ethics*. New Delhi: Oxford University Press, 2017.

4. A N Tripathi, *Human Values*. New Delhi: New Age Publishers, 2019.

5. S. K. Chakraborty. *Values and Ethics for Organizations: Theory and Practices*. New Delhi: Oxford University Press, 1997.

Reference Books:

1.O. C. Ferrell, John Friaedrich and Linda Ferrell. *Business Ethics: Ethical Decision Making and Cases*. New Delhi: Cengage India, 2024.

2.Charles Fledderman. *Engineering Ethics*. 3rd ed. New Delhi: Pearson Education, 2007.

3.Dinesh G. Harkut and Gajendra R. Bamnote. *Professional Ethics for Engineers*. Chennai: Notion Press, 2023.

4.U.C.Mathur, *Corporate Governance and Business Ethics*: *Text and Cases*. Chennai: Macmillan, 2012.

5. Fernando. A. C., K. P. Muralidheeran and E. K. Satheesh. *Business Ethics – An Indian Perspective*. New Delhi: Pearson Education, 2019.

Course Title: **Design Thinking and Innovation**

Course Code: **HU203**

(L-T-P): 1: 0: 0

Total Contact Hours: 15

Credit: 1

Course Objective:

The objective of this Course is to provide new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products and services which are useful for a student in preparing for an engineering career.

Course Outcomes (COs): Upon completion of the course, students shall be able to

1.	Analyze emotional experience and expressions to better understand stakeholders while designing innovative products through group brainstorming sessions.
2.	Generate and develop design ideas through different technique
3.	Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing any innovative products using facility in AICTE IDEA LAB

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	-	2	2	-	2	3	1	-	-
CO2	1	2	3	3	3	-	2	3	-	3	2
CO3	1	3	3	3	3	2	2	3	-	2	2

Prerequisites:

For a course on the Basics of Design Thinking, students should ideally possess basic computer skills, communication abilities, problem-solving aptitude, critical thinking, introductory knowledge of Sustainable Development Goals, curiosity, and openness to new ideas, as well as basic understanding of mathematics, technology, and manufacturing processes.

However, even if these prerequisites are not satisfied, the faculty will cover them in the first few classes.

An awareness of 21st-century skills, including creativity and collaboration, is also beneficial.

These prerequisites aim to provide a foundation, and any gaps in knowledge will be addressed by the instructor early in the course.

SYLLABUS:

Module	Content	Hour
Module 1:	**Basics of Design Thinking:** Definition of Design Thinking, Need for Design Thinking, history of Design Thinking, Concepts & Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;	2
Module 2:	**PROCESS OF DESIGN: Understanding Design thinking** Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping. Stages of Design Thinking Process (explain with examples) – Empathize (Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis). Define (Methods of Define Phase: Storytelling, Critical items diagram, Define success). Ideate (Brainstorming, 2X2 matrix, 6-3-5 method, NABC method). Prototype (Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product). Test (Methods of Testing: Feedback capture grid, A/B testing).	4
Module 3:	**Tools for Design Thinking** Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space– Empathy for design – Collaboration in distributed Design	2
Module 4:	**Design Thinking in IT** Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping	2
Module 5:	**Design Thinking For strategic innovations** Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model	2
Module 6:	**Problem Solving & Critical thinking** Introduction to TRIZ, SCAMPER, UI and UX,	3

	Sustainable development goals (SDG) Integrating and mapping 17 Sustainable development goals (SDG) during designing a product; goods or service. Introduction to 21st Century Skill Set	
	Case Study & Project Report Submission	

Text Books :

1. Karmin Design Thinking by Dr. Bala Ramadurai, Mudranik Technology Private Ltd. ISBN 978-93-5419-0I0-0.
2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
5. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books:

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
2. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009.
4. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
5. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
6. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
7. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.
8. Gavin Ambrose, Paul Harris, Design Thinking, AVA Publishing, 2010.
9. Muhammad MashhoodAlam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
10. S. Balaram, Thinking Design, Sage Publications, 2011.

WEB REFERENCES:

1. https://designthinking.ideo.com/

2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/

3. https://www.coursera.org/learn/design-thinking-innovation

4. https://swayam.gov.in/nd1_noc20_mg38/preview

5.www.tutor2u.net/business/presentations/. /productlifecycle/default.html

6. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf

7. www.bizfilings.com › Home › Marketing › Product Developmen

8. https://www.mindtools.com/brainstm.html

9. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit

10. www.vertabelo.com/blog/documentation/reverse-engineering https://support.microsoft.com/en-us/kb/273814

11. https://support.google.com/docs/answer/179740?hl=en

Course Title: Data Structures and Algorithms Lab
Course Code: CS291
Contact Hours: 0:0:3
Credits: 1.5
Course Objectives

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

- To develop skills in implementing and analyzing data structures using C.
- To gain hands-on experience in solving problems using arrays, linked lists, stacks, queues, trees, graphs, and hashing.
- To apply algorithmic concepts like recursion, sorting, and searching in solving real-world problems.

Course Outcomes (COs):

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

CO1	Apply fundamental programming concepts to construct and manipulate linear data structures

	like arrays, linked list, stacks, and queues for solving structured problems.
CO2	Develop and analyze non-linear data structures such as binary search trees to address hierarchical and dynamic memory-based problems.
CO3	Implement recursive algorithms to solve classical problems like Tower of Hanoi and Fibonacci series, demonstrating critical thinking and abstraction.
CO4	Compare and evaluate various sorting and searching algorithms based on time and space complexity for performance-critical applications.
CO5	Design and integrate suitable data structures to build efficient software modules, demonstrating teamwork, project planning, and communication of technical results.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3			3									
CO 2	3	2			3									
CO 3		2		3	2									
CO 4		3	3		3									
CO 5		2	3		3			2	2	2	3			

Course Content

Lab No.	Title	Topics / Experiments
1	Introduction to C Revisions	Basic C programming constructs, functions, pointer concepts.
2	Arrays and Polynomial Representation	Create, access and manipulate 1D, 2D arrays; polynomial representation using arrays.
3	Linked Lists	Singly Linked List: creation, insertion, deletion, search.
4	Doubly & Circular Linked	Implement doubly linked and circular linked list with

	Lists	insertion/deletion.
5	Stacks (Array & Linked List)	Implement stack using array and linked list.
6	Application of Stack	infix to postfix conversion, postfix evaluation.
7	Queues (Array & Linked List)	Physical, Linear and circular model of queues using array, Queue Using linked list.
8	Recursion Applications	Factorial, Fibonacci, Tower of Hanoi.
9	Binary Search Tree (BST)	Insertion, deletion, searching; height of tree.
10	Sorting Algorithms	Implement of bubble sort, insertion sort, and selection sort.
11	Sorting Algorithms	Implement of quick, merge sort, and radix sort.
12	Searching and Hashing	Linear search, binary search, interpolation search;

Text book:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design in C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

Course Name: Introduction to Artificial Intelligence Lab
Course Code: CS292
Contact: (L:T:P) 0: 0: 3
Total Contact Hours: 30
Credit: 1.5

Prerequisites:

Basic Computer Knowledge

Course Objective(s):

The objective of the course is to make the students able to –

1. Gain foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing.
2. Formulate a problem by analysing its characteristics to fit a State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
4. Build expert systems offering solutions to the challenging problems of Artificial Intelligence.
5. Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Acquire** foundational knowledge of PROLOG to **implement** an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and **understand** the working principle of the agent and **assess** its utilitarian importance in current technological context leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem by analysing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence.
CO3	**Explore** relevant literature and **apply** the concepts of Artificial Intelligence to **solve** a problem by **implementing** well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	**Develop** ideas and **propose an** expert system offering solutions to the challenging problems of Artificial Intelligence.
CO5	**Plan and Implement** Artificial Intelligence based ideas as executable PROLOG programs through **developing** intelligent heuristic strategies or expert systems with adequate documentation in a collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and **investigate** their effectiveness by **analysing** the performances using proper techniques and tools.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO 3	2	2	3	2	-	-	-	-	-	-	-	2	-	2
CO 4	2	2	2	3	-	-	-	-	-	-	-	2	-	2
CO 5	2	2	3	3	2	2	2	2	2	2	2	2	2	3

Course Content:

Module 1: Introduction to PROLOG Programming along with the IDE and its Basic Components (3 Lectures)

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy. Understanding facts, rules, queries, and syntax.

Module 2: Recursive definitions in Prolog (5 Lectures)

Fibonacci Series, Calculator, Factorial, summation, list length, etc. Using recursive rules.

Module 3: Defining facts and simple queries (4 Lectures)

Writing a knowledge base for family relationships, basic objects.

Module 4: **Rules and inference in Prolog (4 Lectures)**

Creating logical rules and testing inferences.

Module 5: List operations in Prolog (4 Lectures)

Checking membership, concatenation, reverse, max/min of list.

Module 6: Pattern matching and symbolic reasoning (5 Lectures)

Simple examples involving pattern recognition (e.g., shape or name matching, Family Tree design)

Module 7: Expert system simulation (Mini project) (5 Lectures)

Building a mini knowledge-based system (e.g., Animal Classification, Medical diagnosis, etc).

Text book:

Prolog Programming for Artificial Intelligence, Ivan Bratko, Addison-Wesley, 4th Edition.

Course Title: Digital Logic and Computer Organization Lab
Course Code: CS293
Contact Hours: 3:0:0
Total Contact Hours: 36
Credits: 1.5

Course Objectives

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

- To provide hands-on experience in designing and analyzing combinational and sequential logic circuits.
- To enhance understanding of digital systems using simulation and HDL tools.
- To familiarize students with arithmetic circuits, memory design, and basic CPU control logic through practical implementation.

Course Outcomes (COs):

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

CO1	Implement and verify the functionality of basic and derived logic gates, using ICs and simulation tools to demonstrate fundamental digital operations.
CO2	Design and simplify combinational logic circuits from Boolean expressions using Karnaugh Maps, and simulate them for correctness and efficiency.
CO3	Construct and analyze sequential circuits such as flip-flops, counters, and shift registers to demonstrate state behavior and timing sequences.
CO4	Develop arithmetic circuits and evaluate algorithmic performance (e.g., Booth's multiplication) using Hardware Description Languages (HDL).
CO5	Integrate combinational and sequential modules to create a simplified CPU architecture through collaborative mini-projects, enhancing teamwork, communication, and project management skills.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	2			3									
CO 2	2	3	3		3									
CO 3	3	2		3	3									
CO 4	3	2			3						3			
CO 5	2		3		3			3	3	2	3			

Course Content

Lab No.	Title	Description
1	Basic Logic Gates	Implement and verify truth tables of NOT, AND, OR, NAND, NOR, XOR, XNOR gates using ICs and simulation software.
2	Boolean Expression Simplification	Design logic circuits from Boolean expressions, simplify using Karnaugh Maps, and simulate the simplified circuit.
3	Combinational Circuit – Adders & Subtractors	Implement Half-Adder, Full-Adder, Half-Subtractor, and Full-Subtractor using logic gates and ICs.
4	Design of Code Converters	Design and implement Binary to Gray, Gray to Binary, Binary to BCD, and BCD to Excess-3 converters.
5	Multiplexers and Demultiplexers	Design and verify 4:1, 8:1 MUX and 1:4, 1:8 DEMUX using logic gates and ICs or simulation tools.
6	Encoders and Decoders	Implement 8-to-3 encoder and 3-to-8 decoder using logic gates and analyze their truth tables.
7	Flip-Flops and Latches	Design and test SR, JK, D, T flip-flops using ICs or HDL; study race-around and master-slave configurations.
8	Synchronous and Asynchronous Counters	Design and simulate up/down counters (binary, mod-n, ring, Johnson) and study their timing behavior.
9	Shift Registers	Implement SISO, SIPO, PIPO, and PISO registers using flip-flops or HDL; demonstrate serial and parallel operations.
10	Arithmetic Circuits Using	Model addition, subtraction, Booth's multiplication, restoring

	HDL	and non-restoring division using Verilog/VHDL.
11	Memory and Address Decoding	Simulate basic RAM/ROM using HDL and design address decoder circuits for memory mapping.
12	Mini Project / CPU Module Simulation	Group-based implementation of a simple CPU datapath (ALU + Register File + Control Unit) using HDL or simulation.

Tools and Resources:

Software: Logisim, Multisim, ModelSim, Xilinx Vivado / ISE, Quartus

Hardware Kits: Digital Trainer Kit, ICs (74xx series), LEDs, switches, Breadboards

Languages: Verilog/VHDL (optional for advanced simulation)

Textbooks:

1. Digital Logic and Computer Design by M. Morris Mano, Pearson Education, 1st Edition
2. Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education, 10th Edition

Reference Books:

1. Digital Design by M. Morris Mano, Michael D. Ciletti, Pearson Education, 5th Edition
2. Computer Organization and Embedded Systems By Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw-Hill Education, 6th Edition
3. Computer Organization and Design: The Hardware/Software Interface By David A. Patterson, John L. Hennessy, Morgan Kaufmann Publishers, RISC-V Edition
4. Fundamentals of Logic Design by Charles H. Roth Jr., Larry L. Kinney, Cengage Learning, 7th Edition
5. Digital Fundamentals by*Thomas L. Floyd*, Pearson Education, 11th Edition

Course Name: ENGINEERING CHEMISTRY LAB
Course Code: CH291
Contact Hours: L:2 T:0 P:0
Total Contact Hours: 24

Credit: 2
Prerequisites: 10+2

Course Objective

1. 01. Study the basic principles of pH meter and conductivity meter for different applications
2. 02. Analysis of water for its various parameters in relation to public health, industries & environment
3. 03. Learn to synthesis Polymeric materials and drugs
4. 04. Study the various reactions in homogeneous and heterogeneous medium
5. 05. Designing of innovative experiments

Course Outcome

CO1	Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2	Able to analyse and determine the composition and physical property of liquid and solid samples when working as an individual and also as a team member
CO3	Able to analyse different parameters of water considering environmental issues
CO4	Able to synthesize drug and sustainable polymer materials
CO5	Capable to design innovative experiments applying the fundamentals of modern chemistry

CO-PO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
1	3	1	3	1	-	2	3	-	-	-	-
2	2	2	1	1	-	1	-	-	-	1	-
3	-	-	-	-	-	-	-	-	3	3	2
4	2	1	2	2	-	-	1	-	-	-	-
5	3	3	3	3	1	1	1	1	-	-	2

COURSE CONTENT

Any 10 experiments to be conducted preferably a combination of estimation, water quality analysis, instrumental analysis and synthesis

1. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution.
2. Estimation of amount of Fe^{2+} in Mohr's salt using permanganometry.
3. To determine the surface tension of a given liquid at room temperature using stalagmometer by drop number method.
4. To determine the viscosity of a given unknown liquid with respect to water at room temperature, by Ostwald's Viscometer.
5. Water quality analysis :

i. Determination of total, permanent and temporary hardness of sample water by complexometric titration.

ii. Determination of Cl^- ion of the sample water by Argentometric method

iii. Determination of alkalinity of the sample water.

iv. Determination of dissolved oxygen present in a given water sample.

6. Determination of the concentration of the electrolyte through pH measurement.

7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.

8. Determination of cell constant and conductance of solutions.

9. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.

10. Determination of Partition Coefficient of acetic acid between two immiscible liquids.

11. Drug design and synthesis

12. Synthesis of polymers (Bakelite) for electrical devices and PCBs.

13. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.

14. Determination of R_F of any amino acid by thin layer chromatography.

15. Saponification /acid value of any oil.

16. Isolation of graphene from dead dry batteries

Course Name: IDEA Lab Workshop
Course Code: ME293

Contact Hours: (L: 0, T: 0, P: 3)
Credit: 1.5

Course Objectives:

1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to build useful and standalone system/ project with enclosures.
4. Learn necessary skills to create print and electronic documentation for the system/project

Course Contents*:*

Module	Topics	
1	Electronic component familiarisation, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.	Introduction to basic hand tools - Tape measure, combination square, Vernier calliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,
2	Familiarisation and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping using (a) breadboard, (b) Zero PCB (c) 'Manhattan' style and (d) custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines.	Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.

3	Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging	3D printing and prototyping technology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab
4	Discussion and implementation of a mini project.	
5	Documentation of the mini project (Report and video).	

Laboratory Activities:

S. No.	**List of Lab activities and experiments**
1.	Schematic and PCB layout design of a suitable circuit, fabrication and testi of the circuit.
2.	Machining of 3D geometry on soft material such as soft wood or modelling w
3.	3D scanning of computer mouse geometry surface. 3D printing of scann geometry using FDM or SLA printer.
4.	2D profile cutting of press fit box/casing in acrylic (3 or 6 m thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5.	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6.	Familiarity and use of welding equipment.

7.	Familiarity and use of normal and wood lathe.
8.	Embedded programming using Arduino and/or Raspberry Pi.
9.	Design and implementation of a capstone project involving embedded hardwa software and machined or 3D printed enclosure.

Reference Books:

S. No.	Title
1.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with LabManual), Khanna Book Publishing, New Delhi.
2.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3.	Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
4.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
5.	The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
6.	The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
7.	Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
8.	The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
9.	Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
10.	Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945,978- 9352131952, 978-9352133703

11.	Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
12.	Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633
13.	Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13 : 978-1260019193.
14.	Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13 : 978- 1484200773
15.	Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.
16.	Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
17.	Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.

2ND YEAR 3RDSEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM301	OPERATING SYSTEM	3	0	0	3	3
2	ENGG	MAJOR	AM302	DESIGN AND ANALYSIS OF ALGORITHM	3	0	0	3	3
3	ENGG	MAJOR	AM303	OBJECT ORIENTED PROGRAMMING	3	0	0	3	3
4	SCI	MINOR	M(AM)301	DISCRETE MATHEMATICS	3	0	0	3	3
5	ENGG	MINOR	EC(AM)301	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3	3
B. PRACTICAL									
1	ENGG	MAJOR	AM391	OPERATING SYSTEM LAB	0	0	3	3	1.5
2	ENGG	MAJOR	AM392	DESIGN AND ANALYSIS OF ALGORITHM LAB	0	0	3	3	1.5
3	ENGG	MAJOR	AM393	OBJECT ORIENTED PROGRAMMING LAB	0	0	3	3	1.5
4	ENGG	SKILL ENHANCEMENT COURSE	AM394	IT WORKSHOP (Sci LAB/ MATLAB/ PYTHON/ R)	0	0	3	3	1.5
5	ENGG	MINOR	EC(AM)391	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	0	0	3	3	1.5

Total of Theory, Practical	**30**	**22.5**

Course Name: Operating System

Course Code: AM301
Contact: 3:0:0
Total Contact Hours: 36L
Credits: 3

Prerequisites: 1. Computer organization

2. Computer Architecture

3. Data Structures

4. Algorithms & Programming

Course Objectives

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

- Learn concepts of operating systems
- Learn the mechanisms of OS to handle processes
- Study of various mechanisms involved in memory management techniques
- Gaining knowledge of deadlocks prevention and detection techniques
- Analysing disk management functions and techniques

Course Outcomes (COs):

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

CO1	Understand the fundamental concepts of Operating System, Protection & Security and differentiate different types of Operating System.
CO2	Understand and implement process & thread; understand, apply, compare different process synchronization algorithm and inter process communication to solve engineering problems
CO3	Understand/explain/analyze different synchronization techniques, critical section problems and deadlock and apply them to solve engineering problems.
CO4	Understand/explain different memory management techniques including virtual memory management; also able to apply, compare, and implement different page replacement algorithms to solve engineering problems
CO5	Understand/explain different I/O mechanisms, File structures and disk management techniques and solving engineering problems applying different disk scheduling algorithms

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

CO1	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Course Content

Module – 1: [3L]

Functionalities of Operating System, Evolution of Operating System. Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security

Module – 2: [9L]

Processes: Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, [2L] Threads: overview, benefits of threads, user and kernel level threads. [1L] CPU scheduling: Scheduling criteria, preemptive& non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling). [6L]

Module – 3: [10L]

Process Synchronization: background, critical section problem, synchronization hardware, classical problems of synchronization (producer-consumer, readers-writer, dining philosophers, etc), semaphores.[5L] Deadlocks: deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.[5L]

Module 4: [6L]

Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB. [3L] Virtual Memory: background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model. [3L]

Module 5: [8L]

Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK etc), disk reliability, disk formatting, boot block, bad blocks. [2L] File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector). [2L] I/O: I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O. [1L] Case Study: Inter-process communication: Message passing. Thread models, monitors [3L]

Textbook:

- Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.
- Operating systems: concepts and design by Milan Milenkovič- Mc. Graw-Hill Publication

Reference Books:

- Dietel H. N., ―An Introduction to Operating Systems‖, Addison Wesley
- Andrew Tanenbaum, Modern Operating Systems, Prentice Hall
- William Stallings, Operating Systems, Prentice Hall.

Course Name: Design & Analysis of Algorithm

Code: AM302

Contact: 3:0:0

Total Contact Hours:36L

Credits: 3

Prerequisites: To know data-structure and basic programming ability

Course Objectives:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To understand and illustrate the concepts of time and space complexity, worst case, average case and best-case complexities and the asymptotic notation.
CO2	To analyze and apply the design principles and concepts to various basic algorithm design viz. dynamic programming, greedy methods etc.
CO3	To understand and analyze various string matching and graph algorithms.
CO4	To understand ,illustrate and analyze the different complexity classes
CO5	To discuss ,implement and analyze, verify the efficiency of the randomized and approximation algorithms.

CO-PO Mapping:

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

Course Content:

Module-1: [4L]

Algorithm Development & Complexity Analysis: [4L] Stages of algorithm development for solving a problem: Describing the problem, identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm. Time and Space Complexity, Different Asymptotic notations – their mathematical sig

Module-2: [14L]

Algorithm Design Techniques Brute force techniques – Traveling Salesman Problem, Divide and Conquer - Matrix multiplication: Strassen algorithm, Greedy techniques - Fractional Knapsack problem, Job Sequencing with Deadline, Graph Coloring, Finding Minimum Cost Spanning Tree using Prim's and Kruskal's algorithm, Dynamic programming - O/1 Knapsack problem, Matrix chain multiplication, Travelling Salesman Problem, Backtracking-N-Queens Problem, Knights Tour on Chess Board.

Module-3: [3L]

String matching problem: Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Module-4: [5L]

Graph Algorithms Single Source Shortest Path -Dijkstra Algorithm, All pair shortest path – Floyd-Warshall Algorithm. Network Flows, Maximum Flows – Ford-Fulkerson Algorithm, Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm

Module-5: [5L]

Complexity Classes: The Class P, The Class NP, Reducibility and NP-completeness – SAT (without proof), 3-SAT, Vertex Cover, Independent Set, Maximum Clique.

Module-6: [5L]

Approximation and Randomized Algorithms [3L], Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering. Randomized Algorithms - The hiring problem, Finding the global Minimum. Recent Trends

Text Books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.

2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman. 3. "Algorithm Design" by Kleinberg and Tardos..

Reference Books:

1. Design & Analysis of Algorithms, Gajendra Sharma,Khanna Publishing House, NewDelhi
2. Design Analysis and Algorithms ǁby Hari Mohan Pandey.

Course Name: Object Oriented Programming using Java

Course Code: AM303

Contact: 3:0:0

Total Contact Hours: 36L

Credits: 3

Prerequisites:Partial Object-Oriented Programming using C++

Course Objectives:

- The model of objectoriented programming: abstract data types, encapsulation, inheritance and polymorphism
- Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
- How to test, document and prepare a professional looking package for each business project using javadoc.

Course Outcomes(COs):

After attending the course students should be able to

CO1	Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
CO2	Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
CO3	Analyze various activities of different string handling functions with various I/O
CO4	Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface.
CO5	Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

CO-PO Mapping:

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

Course Content:

Module 1: [2L]

Introduction: Object Oriented Analysis (OOA) & Object Oriented Design (OOD) - Concepts of object oriented programming language, Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. [1L]; Object Oriented Programming concepts - Difference between Java and C++; Different features of Java [1L];

Module 2: [10L]

Java Basics: Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables.[1L] ;Java Operators & Control statements [1L]; Java loops. [1L]; Array.[1L] ;Creation of class, object, method. [1L]; Constructor-Definition, Usage of Constructor, Different types of Constructor.[1L]; finalize method

and garbage collection, Method & Constructor overloading. [1L]; this keyword, use of objects as parameter & methods returning objects.[1L]; Call by value & call by reference. [1L]; Static variables &methods.Nested& inner classes.[1L].

Module 3: [5L]

Basic String handling & I/O: Basic string handling concepts- Concept of mutable and immutable string, Methods of String classcharAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). [1L]; toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). [1L];ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). [1L] ;Command line arguments, basics of I/O operations – keyboard input using BufferedReader [1L] ; Scanner class in Java I/O operation [1L];

Module 4: [8L]

Inheritance and Java Packages: Inheritance - Definition, Advantages, Different types of inheritance and their implementation. [1L] ;Super and final keywords, super() method. [1L]; Method overriding, Dynamic method dispatch.[1L]; Abstract classes & methods.[1L]; Interface - Definition, Use of Interface.[1L]; Multiple inheritance by using Interface.[1L] ;Java Packages -Definition, Creation of packages. [1L]; Java Access Modifiers - public, private, default and protected, Importing packages, member access for packages. [1L]

Module 5: [11L]

Exception handling, Multithreading and Applet Programming : Exception handling - Basics, different types of exception classes.Difference between Checked & Unchecked Exception.[1L]; Try & catch related case studies.[1L]; Throw, throws & finally. [1L]; Creation of user defined exception. [1L]; Multithreading - Basics, main thread [1L]; Thread life cycle.[1L]; Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().[1L] ;Thread priorities, thread synchronization.[1L];Inter thread communication, deadlocks for threads[1L]; Applet Programming - Basics, applet life cycle, difference between application & applet programming[1L]; Parameter passing in applets. [1L]

Text Books:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH

2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.

2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

Course Name: DISCRETE MATHEMATICS

Course Code: M(AM)301

Contact: (L:T:P): 3 :0 : 0

Total Contact Hours: 36

Credit: 3

Prerequisites:

The students to whom this course will be offered should have a fundamental understanding of (10+2) standard set theory, algebra, and logic, along with the ability to follow formal mathematical notation and basic proof techniques.

Course Objective(s):

The objective of the course is to make the students able to –

1. Develop a conceptual understanding of set theory, relations, lattices, combinatorics, and propositional logic to model discrete mathematical systems.
2. Gain proficiency in applying number theory and algebraic structures—such as groups, rings, and fields—for logical reasoning and problem-solving in computing contexts.
3. Build the skill to tackle problems involving graphs, trees, and recurrence relations using algorithmic approaches and generating functions.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply fundamental concepts of set theory, relations, lattices, and combinatorics to model structured and logical problems in computing.

CO2	Apply number theoretic techniques and algebraic structures such as groups and rings in the design and analysis of secure and efficient computational systems.
CO3	Analyze logical propositions using propositional logic and truth tables to draw valid conclusions and verify the consistency of logical systems.
CO4	Analyze the structural properties and relationships within computational and engineering problems using graph theory and tree-based algorithms.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	1	-	-	-	-	-	-	2			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M(AM)301	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**			

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'.

Course Content:

Module-I: Set Theory [11L]

Posets& Lattices: [6L]

Relation: Types of Relations, Properties of Binary Relation, Equivalence Relation, Partial Ordering Relation and Posets, Lattices.

Combinatorics: [2L]

Principle of Inclusion Exclusion, Pigeon Hole Principle.

Generating Functions and Recurrence Relations: [3L]

Generating functions, Recurrence relations: Formulation of different counting problems in terms of recurrence relations, Solution of recurrence relations with constant coefficients by Generating functions method.

Module-II: Propositional Logic[5L]

Basics of Boolean Logic, Idea of Propositional Logic, well-formed formula, Logical Connectives, Truth tables, Tautology, Contradiction, Algebra of proposition, Logical Equivalence, Normal Forms: Disjunctive Normal Forms (DNF) and Conjunctive Normal Forms (CNF).

Module-III: Number Theory [4L]

Well-Ordering Principle, Divisibility theory and properties of Divisibility, Fundamental theorem of Arithmetic, Prime and Composite Numbers, Greatest Common Divisor and Euclidean Algorithm, Congruence, Residue Classes.

Module-IV: Algebraic Structures [8L]

Concepts of Groups, Subgroups and Order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation Groups and Symmetric Groups, Definition of Ring and Field.

Module-V: Graph Theory [8L]

Graph theory, Theorems (statement only), Digraphs, Weighted Graph, Walk, Path, Circuit, Connected and Disconnected Graph, Bipartite Graph, Complement of a Graph, Regular Graph, Complete Graph, Adjacency and Incidence matrices of a graph (digraph), Dijkstra's algorithm.

Tree, Binary Tree, Theorems on Tree (statement only), Spanning Tree, Minimal Spanning Tree, Kruskal's Algorithm, Prim's Algorithm.

Text Books:

1. Graph Theory with Applications to Engineering and Computer Science, Deo, N., Prentice Hall.
2. Higher Algebra: Abstract and Linear, Mapa, S. K., Levant, 2011.
3. Discrete Mathematics, Chakraborty, S. K. and Sarkar,B. K., OXFORD University Press.
4. Discrete Mathematics and its Applications, Rosen, K. H., Tata McGraw – Hill.

Reference Books:

1. Higher Engineering Mathematics, Grewal, B. S., Khanna Pub.
2. Advanced Engineering Mathematics, Kreyzig, E., John Wiley and Sons.
3. Discrete Mathematics, Sharma, J.K.,Macmillan.
4. Elements of Discrete Mathematics A Computer OrientedApproach, 3rd Edition, Liu, C. L. and Mohapatra, D. P.,Tata McGraw – Hill.
5. Discrete Mathematical Structure and It's Application to Computer Science, TMG Edition, Tremblay, J. P. and Manohar, R.,TataMcgraw-Hill.

Course Name: Fundamentals of Electrical and Electronics Engineering

Course Code: EC(AM)301

Contact: 3L:0T:0P

Total Contact Hours: 36

Credit: 3

Prerequisite: Basic 12th standard Physics and Mathematics, Concept of components of electrical

and electronic circuits.

Course Objectives: The objectives of this course are to

Obj.1. Introduce the fundamental concepts of electrical quantities, circuit elements, and semiconductor devices.

Obj.2. Develop the ability to analyze DC and AC circuits using systematic techniques.

Obj.3. Provide an overview of electrical machines and their working principles.

Obj.4. Familiarize students with practical electrical installations, components, and electronic circuits.

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

CO1. Define and explain fundamental terminologies and laws related to electrical and electronic circuits.

CO2. Illustrate the working principles of electrical machines, semiconductor devices, and their applications.

CO3. Analyze DC and AC circuits using circuit laws and phasor techniques.

CO4. Apply knowledge of electrical and electronic components in practical circuits and Installations.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	2	-	-	-	1	2
CO2	3	2	2	-	2	2	-	-	-	1	3
CO3	3	3	3	3	-	2	-	-	-	2	2
CO4	3	2	3	2	2	2	1	-	1	2	3

Course Content

Module 1: Elementary Concepts of Electric Circuits 10L

i. DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor, Ohm's Law, Kirchhoff's Laws, Independent and Dependent Sources, Simple problems, Nodal Analysis, Mesh analysis with independent sources only (Steady state)

ii. Introduction to AC Circuits and Parameters: Calculation of average value, RMS Value, peak factor and form factor (Sinusoidal, Triangular and Square waveform only), concept of impedance and its complex representation, impedance triangle, phasor diagram of voltage and current in RL, RC and RLC circuits (sinusoidal excitation only), real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only).

Module 2: Electrical Machines 8L

i. Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, emf equation, equivalent circuit, losses in transformers, efficiency (no derivation), Simple problems on emf equation only.

ii. DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on voltage equation.

Module 3: Fundamentals of Semiconductor Devices 3L

Introduction to Semiconductor: Concept of energy band diagram; Comparison among metal, insulator, semiconductor; Current flow in semiconductor due to drift and diffusion process.

Module 4: PN Junction Diode 6L

Principle of operation; V-I characteristics; principle of avalanche and Zener breakdown; Junction resistances and capacitances; V-I characteristics of Zener diode, Diode rectifiers – half wave and full wave, simple problems on rectifiers.

Module 5: Bipolar Junction Transistors 4L

PNP and NPN structures; Principle of operation; Current gains in CE, CB and CC mode; input and
output characteristics; Biasing – Concept of Fixed Bias, Collector to base Bias & voltage divider
bias, application of transistor as a switch.

Module 6: Introduction to IC 5L

Integrated circuit – Basic idea, classifications, advantages, disadvantages; Op-Amp (IC741) – Pin
configuration and characteristics; Inverting and Non-Inverting Amplifier; Adder, Subtractor, Differentiator and Integrator Circuit, Comparator, Simple problems on different circuits.

Text Books:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, TMH.
2. Ashfaq Hussain, “Basic Electrical Engineering”, Dhanpat Rai Publication.
3. C.L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.
4. D. Chattopadhyay, P.C Rakshit, “Electronics Fundamentals and Applications”, New Age International (P) Limited Publishers, Seventh Edition, 2006.
5. Abhijit Chakrabarti and Sudip Debnath, “Basic Electrical and Electronics Engineering – I”, McGraw Hill, 2015.
6. M.S. Sukhija and T.K. Nagsarkar, “Basic Electrical and Electronics Engineering”, Oxford University Press, 2012.

Reference Books:

1. D.C. Kulshreshtha,“Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. T.K. Nagsarkar, M.S.Sukhija, “Basic Electrical Engineering”, Oxford Higher Education.
3. Hughes, “Electrical and Electronic Technology”, Pearson Education.
4. Anant Agarwal, Jeffrey Lang, “Foundations of Analog and Digital Electronic Circuits”, Morgan Kaufmann Publishers, 2005.
5. Bernard Grob, “Basic Electronics”, McGrawHill.
6. Chinmoy Saha, Arindham Halder and Debarati Ganguly, “Basic Electronics – Principles and Applications”, Cambridge University Press, 2018.

Course Name: Operating Systems Lab

Course Code: AM391

Contact: 0:0:3

Credit: 1.5

Prerequisites: 1. Computer organization

2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Objectives:

- To write programs in Linux environment using system calls.
- To implement the scheduling algorithms.
- To implement page replacement algorithms
- To implement file allocation methods.
- To understand and implement ipc mechanism using named and unnamed pipes.
- To develop solutions for synchronization problems using semaphores

Course Outcomes(COs):

After attending the course students should be able to

CO1	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority
CO2	Understand the concepts of deadlock in operating systems.
CO3	Implement them in Multiprogramming system.
CO4	Create process creation and implement inter process communication
CO5	Analyze the performance of the various page replacement schemes

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	-	-	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	-	-	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	-	-	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	-	-	**3**	**3**	**3**

CO5	3	3	3	3	3	-	-	-	3	-	-	3	3	3

Course Content:

1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep,grep,fgrep,find,sort,cal,banner,touch,filerelatedcommands–ws,sat,cut,grep etc.Mathematical commands–expr, factor, units, Pipes(use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)
2. **Shell Programming[6P]:**Creatingascript,makingascriptexecutable,shellsyntax(variables, conditions,control structures, functions, and commands).
3. **Process[3P]**:Startingnewprocess,replacingaprocessimage,duplicatingaprocessimage.
4. **Semaphore[3P]:** Programming with semaphores (use functions semget, semop, semaphore_p,semaphore_v).
5. **POSIX Threads[6P]:** Programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit,pthread_attr_init, pthread_cancel) .
6. **Shared Memory [9P]:**Create the shared memory , Attach the shared memory segment to the address space of the calling process , Read information from the standard input and write to the shared memory,

Read the content of the shared memory and write on to the standard output , Delete the shared memory

Books:

1. YashavantP.Kanetkar, UNIX Shell Programming,1st edition, BPB Publications
2. Beej's Guide to Unix IPC
3. W.Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

Course Name: Design and Analysis of Algorithm lab

Lab Course Code: AM392

Contact: 0:0:3

Credit: 1.5

Prerequisites: Programming knowledge

Course Objectives:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To identify and prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO2	To understand and illustrate methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis)
CO3	To analyze and design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
CO4	To understand, compare, contrast, and choose appropriate implementation of the algorithmic design techniques to present an algorithm that solves a given problem.
CO5	To Identify and analyze criteria and specifications appropriate to new problems.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**2**	**3**	-	-	-	**3**	-	-	-	-	**2**
CO2	**3**	**3**	**3**	**2**	**3**	-	-	-	**3**	-	-	-	-	**2**
CO3	**3**	**3**	**2**	**3**	**3**	-	-	-	**3**	-	-	-	-	**3**

CO4	3	3	2	2	3	-	-	-	3	-	-	-	-	3
CO5	3	3	3	2	3	-	-	-	3	-	-	-	-	3

Course Content:

A. Implementation of various Divide & Conquer Methods; viz. Matrix Multiplication.

B. Implementations of various Dynamic Programming Methods, viz. Matrix Chain Multiplication Method, Travelling Salesman Problem etc.

C. Implementations of various Branch & Bound Techniques, viz.

D. Implementations of various Backtracking Methods, viz. n-Queen Problem.

E. Implementations of Greedy Method, viz. Fractional Knapsack Problem, Job Sequencing Problem etc.

F. Implementations of String-matching Algorithm viz. Naïve Algorithm, String Matching with Finite Automata etc.

G. Implementations of Various Graph Algorithms, viz. Dijkstra ‘s Algorithm, Floyd Algorithm etc.

H. Implementation of some Real-Life Trendy Problem

Text Books:

1. . "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman. 3. "Algorithm Design" by Kleinberg and Tardos..

Course Name: Object Oriented Programming using Java Lab

Lab Course Code: AM393

Contact: 0:0:3

Credit: 1.5

Prerequisites:1. Computer Fundamentals

2. Basic understanding of Computer Programming and related ProgrammingParadigms

3. Problem Solving Techniques with proper logic Implementation.

Course Objectives:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling
- and file processing.
- To develop applications using generic programming and event handling.

Course Out comes(COs):

After attending the course students should be able to

CO1	Create the procedure of communication between Objects, classes & methods.
CO2	Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java..
CO3	Analyze distinct features of different string handling functions with various I/O
CO4	Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
CO5	Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

CO-PO Mapping:

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

Course Content:

1:Java Basics:

1. Simple Java programming using operators, control statements & loops, array.
2. Programming on class, object, and method, access specifier.
3. Programming on constructor, method/constructor overloading.
4. Programming on this keyword, call by value & call by reference, static variables & methods, inner classes.

2: Basic String handling & I/O:

1. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods.
2. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods.
3. Programming on Command line arguments. 4. Programming using keyboard input by implementing Buffered Reader& Scanner classes.,

3: Inheritance, Interface and Java Packages:

1. Programming on Simple Inheritance, super and final keywords, super() method.

2. Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface.

3. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, subclassing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package.

4. Exception handling, Multithreading and Applet Programming:

1. Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception.

2. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface, creating child threads by assigning thread priorities.

3. Programming on creating simple applet to display some message, creating applet two add 2 integers, creating applet to do GUI based programming.

Text Books:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH

2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.

2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

Course Name: IT WORKSHOP(Python)

Course Code: AM394

Contact: 0:0:3

Credit: 1.5

Prerequisites: Knowledge of Mathematics and basic concepts of Programming

- To develop foundational programming skills using Python, including variables, data types, operators, loops, and functions.
- To apply core Python data structures such as strings, lists, sets, and dictionaries for solving real-world problems.
- To perform file handling and explore basic input/output operations essential for software development.
- To utilize the NumPy library for numerical computing and implement simple logic-based applications like games.

Course Outcomes(COs):

After attending the course students should be able to

CO1	Understand basic of Python Programming Language
CO2	Understand the use of Conditional statement and Loops
CO3	Learn functions in python and represent collection type data using List and Dictionary
CO4	Read and write data from & to files in Python

CO5	Understand Numpy array and numerical operations on Numpy array.

CO-PO Mapping:

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

Course Content:

1. Basics of Python: Python Installation, python variables, data types and Operator.
2. Loops: While and For loops, Python Syntax, Colon & Indentation, Conditional Statements: if, elif and else.
3. Functions: Defining Functions in python; passing arguments.
4. String: Python Programming to explore string functions
5. Lists: Python programs using Lists; understand the use of List methods, Slicing on List.
6. Sets: Working with Sets; Write programs to show different set operations.
7. Dictionary: Demonstrate the use of Dictionaries
8. File handling: Reading & Writing data from a file, Redirecting output streams to files.
9. Numpy: Numerical operations using Numpy array; slicing numpy array; stacking numpy arrays; Write programs to show different numerical operations on numpy array;. Finding Puzzle) Playing (Tic-Tac-Toe)

Course Name: Fundamentals of Electrical and Electronics Engineering Lab

Course Code: EC(AM)391

Contact: 0L:0T:3P

Credit: 1.5

Prerequisite: Basic Physics and applied physics, Basic Mathematics, Basic concept of Electricaland Electronic Circuits.

Course Objectives:

Obj.1. Provide hands-on experience with basic electrical and electronic components, instruments, and equipment.

Obj.2. Develop practical skills in conducting experiments on electrical circuits, machines, and semiconductor devices.

Obj.3. Enhance the ability to record, interpret, and analyze experimental data.

Obj.4. Inculcate awareness of laboratory safety measures and teamwork in performing experiments.

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

CO1. Identify and operate various electrical/electronic equipment while following safety measures.

CO2. Conduct experiments and evaluate the performance characteristics of electrical machines and devices.

CO3. Interpret, analyze, and validate the results of laboratory experiments.

CO4. Apply experimental knowledge in designing/testing basic electrical and electronic circuits.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**-**	**3**
CO2	**3**	**3**	**-**	**3**	**2**	**-**	**3**	**3**	**3**	**-**	**3**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**-**	**3**
CO4	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**

List of Experiments:

1. Familiarization with different passive and active electrical and electronic components.
2. Familiarization with different Electrical and Electronics Instruments.
3. Verification of KVL and KCL.
4. Forward and reversal of DC shunt motor.
5. Find the losses of a single-phase transformer by open-circuit and short-circuit tests.
6. Study of the P-N junction diode V-I characteristics (Forward and Reverse Bias).
7. Study of the Characteristics of Zener diode (Forward & Reverse Bias).
8. Study of the Input and Output characteristics of BJT in CE mode.
9. Determination of offset voltage, offset current and bias current of Op-Amp (IC741).
10. Determination of CMRR and slew rate of Op-Amp (IC741).
11. Determination of inverting and non-inverting gain of Op-Amp (IC741).
12. Extramural Experiment.

2ND YEAR 4TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM401	**DATABASE MANAGEMENT SYSTEMS**	3	0	0	3	3
2	ENGG	MAJOR	AM402	**ADVANCED ARTIFICIAL INTELLIGENCE**	3	0	0	3	3
3	ENGG	MAJOR	AM403	**THEORY OF COMPUTATION**	3	0	0	3	3
4	SCI	MINOR	M(AM)401	**PROBABILITY AND STATISTICS**	3	0	0	3	3
5	HUM	ABILITY ENHANCEMENT COURSE	HU(AM)401	**PROJECT MANAGEMENT AND FINANCE**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM491	**DATABASE MANAGEMENT SYSTEMS LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM492	**ADVANCED ARTIFICIAL INTELLIGENCE LAB**	0	0	3	3	1.5
3	ENGG	SKILL ENHANCEMENT COURSE	AM493	**ADVANCED IT WORKSHOP (Sci LAB/ MATLAB/ PYTHON/ R)**	0	0	3	3	1.5
4	SCI	ABILITY ENHANCEMENT COURSE	HU(AM)491	**SOFT SKILL AND APTITUDE**	0	0	2	2	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM481	**RESEARCH METHODOLOGY& IPR**	1	2	0	3	2
Total of Theory, Practical									**22**
TOTAL SECOND YEAR CREDIT									**44.5**

Course Name: Database Management Systems

Course Code: AM401

Contact: 3:0:0

Total Contact Hours: 36L

Credits: 3

Prerequisites: 1. Logic of programming language

2. Basic concepts of data structure and algorithms

Course Objectives:

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization.
- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To Understand and Describe the basic concepts and utility of Database management system, different data models of Database management system.
CO2	To Design an Entity Relationship (E-R) Diagram and relational model for any kind of real-life application and able to Apply relational algebra operations, SQL, Neo4j for solving query
CO3	To Analyze and Create the relational database for any real-life applications based on normalization.
CO4	To Apply the query optimization techniques, different file organization techniques and determine whether the transaction satisfies the ACID properties.
CO5	Explore DBMS based ideas through developing software programs with adequate documentation in collaborative environment for successfully carrying out projects on DBMS Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools and assess the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learnin

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	PSO1	PSO2	PSO3

CO1	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2		-	-	-	-	2	2	2	3

Course Content:

Module – 1: Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module – 2:Entity-Relationship and Relational Database Model [11L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module – 3:Graph Based Model [4L]

Concept of graph-based model, difference between relational model and graph-based model, application, overview of Neo4j CQL.

Module – 4:SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module - 5: Relational Database Design [8L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module - 6:Internals of RDBMS [8L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module - 7:File Organization & Index Structures [3L]

File & Record Concepts, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes.

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Reference Books:

1 "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B. Navathe, Addison Wesley Publishing

2. Ramakrishnan: Database Management System, McGraw-Hill.

Course Name: Advanced Artificial Intelligence

Course Code: AM402

Contact: 3:0:0

Total Contact Hours: 36L

Credits: 3

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objectives:

- Understand the foundational principles and history of AI and its applications in various domains.
- Formulate real-world problems using state-space exploration and solve them using both uninformed and informed search techniques.
- Apply heuristic and metaheuristic methods such as A*, genetic algorithms, simulated annealing, and swarm optimization for complex problem-solving.

- Analyze and implement adversarial search strategies used in game-playing environments.
- Develop knowledge representation models using propositional and predicate logic, semantic nets, frames, scripts, and conceptual dependencies.
- Explore reasoning under uncertainty using probabilistic models including Bayesian networks, Dempster-Shafer theory, fuzzy logic, and Hidden Markov Models.
- Understand and implement AI planning algorithms and explore planning as a problem-solving technique.

Course Outcomes (COs):
After attending the course students should be able to

CO1	Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	Identify and formulate an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing Model/Agent Design Framework within the scope of Artificial Intelligence paradigm.
CO3	Explore relevant literature and apply the concept of Heuristic Techniques of Artificial Intelligence to solve problems.
CO4	Develop Inferencing Models for proposing solutions to the problems of Artificial Intelligence
CO5	Implement Inferencing Models of Artificial Intelligence through developing feasible algorithms and investigate their effectiveness by analyzing their performances in solving the relevant problems.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-				3	3	-	-
CO2	2	3	-	-	-	-	-				-	-	3	-
CO3	2	2	3	2	-	-	-				-	2	-	2
CO4	2	2	2	3	-	-	-				2	2	-	2
CO5	2	2	3	3	2						2	2	2	3

Course Content:

Module – 1Introduction to Artificial Intelligence [1L]

Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, Applications of Artificial Intelligence

Module – 2Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching [5L]

Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, Farmer-Wolf-Goat-Cabbage Problem, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching. Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bidirectional Search.

Module – 3 Heuristic Techniques for Goal Searching [8L]

Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, Memory-bounded heuristic search: Iterative-deepening A* Search, Recursive Best First Search, Simplified Memory Bounded A* Search. Simulated Annealing Based Stochastic Search, Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization, Particle Swarm Optimization.

Module 4 Adversarial Search for Game Playing [2L]

Basic Concepts, Minimax Search, Alpha-Beta Pruning

Module 5: Knowledge Representation and Inference using Propositional Logic and Predicate Logic [5L]

Propositional Logic: Knowledge Representation and Inference using Propositional Logic Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module 6:Slot-and-Filler Structure for Knowledge Representation[2L]

Weak Slot-and-Filler Structure for Knowledge Representation: Semantic Nets and Frames. Strong Slot-and-Filler Structure for Knowledge Representation: Conceptual Dependency and Script

Module 7:Reasoning under Uncertainty [5L]

Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing, Overview of Hidden Markov Model.

Module 8:Planning [5L]

Basic Concepts, Problem of Blocks World, Components of a Planning System, Algorithms for Planning: Goal Stack, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Algorithms for Planning as State-Space Search, Heuristics for planning, Planning Graphs and GRAPHPLAN Algorithm.

Module 7:Introduction to Natural Language Processing [1L]

Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Reference Books:

1. "Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill

Course Name: Theory of Computation

Course Code: AM403

Contact: 3:0:0

Total Contact Hours: 36L

Credits: 3

Prerequisites: 1. Digital Logic
2. Computer organization
3. Computer Fundamentals

Course Objectives:

- This course will introduce Learners areas about three foundational of computer science namely the basic mathematical models of computation, problems that can be solved by computers and problems that are computationally hard.
- It also introduces basic computation models, their properties and the necessary mathematical techniques to prove more advanced attributes of these models.

- The learners will be able to express computer science problems as mathematical statements and formulate proofs.

Course Outcomes (COs):
After attending the course students should be able to

CO1	Understand the fundamental concepts of Finite State Automata to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Regular Expressions and its relation with DFA so that they can Develop regular expression for a specified language and Validate it.
CO3	Understand the fundamental concepts of Context Free Grammar so that they can Design grammar for a specified language and Validate it.
CO4	Explain or Illustrate the fundamental operating principles of Push Down Automata and Use it appropriately to Solve problems.
CO5	Understand the operating principles of Turing Machine and Design Turing Machines to Proposesolutionstotherelatedproblemsappropriatelyandvalidatetheeffectivenessaswell as limitations of computations making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3							3	3	3	3
CO2	2	2	2	2							3	3	3	3
CO3	3	3	3	3							3	3	3	3
CO4	3	3	3	3							3	3	3	3
CO5	3	3	3	3				2	2		3	3	3	3

Course Content:
Module – 1:[9L]

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, [1L]

Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automation (DFA) and Non-deterministic Finite Automation (NFA), Transition diagrams, Transition tables and Language recognizers. [3L]

NFA with empty transitions, Equivalence between NFA with and without empty transitions. NFA to DFA conversion. [2L]

Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill-Nerode Theorem [2L] Limitations of FSM, Application of Finite Automata[1L]

Module – 2: [7L]

Finite Automata with output − Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore & Mealy Machine – Interconversion. [2L]

Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of Mealy Machine [1L]

Minimization of incompletely specified machine−Merger Graph, Merger Table, Compatibility Graph [2L] Lossless and Lossy Machine – Testing Table, Testing Graph [2L]

Module – 3: [5L]

Regular Languages, Regular Sets, Regular Expressions, Algebraic Rules for Regular Expressions, Arden‘s Theorem statement and proof [1L]

Constructing Finite Automata (FA) for given regular expressions, Regular string accepted by FA [2L] Constructing Regular Expression for a given Finite Automata [1L]

Pumping Lemma of Regular Sets. Closure properties of regular sets [1L]

Module 4: [10L]

Grammar Formalism-Context Free Grammars, Derivation trees, sentential forms. Rightmost and leftmost derivation of strings, Parse Tree, Ambiguity in context free grammars. [1L]

Minimization of Context Free Grammars. [1L]

Removal of null and unit production [1L]

Chomsky normal form and Greibach normal form. [1L]

Pumping Lemma for Context Free Languages. [1L]

Enumeration of properties of CFL, Closure property of CFL, Ogden‘s lemma & its applications [1L] Regular grammars−right linear and left linear grammars [1L]

Pushdown Automata: Pushdown automata, definition. Introduction to DCFL, DPDA, NCFL, NPDA [1L] Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L] Equivalence of CFL and PDA, inter-conversion. [1L]

Module 5: [5L]

Turing Machine: Definition, model [1L] Design of TM, Computable functions [1L],

Church ‘s hypothesis, counter machine [1L] Types of Turing machines [1L]

Universal Turing Machine, Halting problem [1L]

Text Books:

1. Introduction to Automata Theory Languages and Computation‖, Hopcroft. E. and Ullman J.D., Pearson Education.

Reference Books

1. Formal Languages and Automata Theory, C. K. Nagpal, Oxford 2. Switching and Finite Automata Theory, Zvi Kohavi, 2nd Edition, Tata McGraw Hill

Course Name: PROBABILITY AND STATISTICS

Course Code: M(AM)401

Contact: (L:T:P): 3 : 0 : 0

Total Contact Hours: 36

Credit: 3

Prerequisites:

The students to whom this course will be offered should have a fundamental understanding of (10+2) standard calculus,elementary probability, set theory, functions, and basic counting principles to effectively comprehend the probabilistic and statistical concepts.

Course Objective(s):

The objective of the course is to make the students able to –

4. Develop a strong foundation in probability theory and random variables to model computational uncertainty and data-driven phenomena.
5. Gain analytical skills in joint distributions, correlation, regression, and parameter estimation relevant to machine learning and data analysis.
6. Build the competence to apply statistical hypothesis testing in evaluating algorithms,

systems performance, and experimental results.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Apply the concepts of probability distributions and random variables to model uncertainty in computational and data-driven systems.
CO2	Apply sampling theory and parameter estimation techniques to infer population characteristics and support data-driven decision-making.
CO3	Analyze bivariate data using joint, marginal, and conditional distributions, correlation, and linear regression to interpret relationships and dependencies in real-world datasets.
CO4	Analyze decision-making scenarios using hypothesis testing procedures to examine statistical assumptions and validate system performance.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1			
CO2	3	2	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	1	-	-	-	-	-	-	2			
CO4	3	3	1	1	-	-	-	-	-	-	2			
M(AM)401	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**			

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'.

Course Content:

Module-I: Probability and Random Variables **[10L]**

Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, Moments, Moment generating functions, Binomial, Poisson, Uniform, Exponential and Normal distributions

Module-II: Two Dimensional Random Variables **[9L]**

Joint distributions, Marginal and conditional distributions, Covariance, Correlation and linear regression, T Transformation of random variables, Central limit theorem (for independent and identically distributed random variables).

Module-III: Sampling Theory & Estimation of Parameters **[10L]**

Sampling Theory: Random sampling, Parameter & Statistic, Standard error of statistic, Distributions of the sample mean and the sample variance for a normal population, Chi-Square distributions, t distributions and F distributions.

Estimation of Parameters: Unbiased and consistent estimators, Point estimation, Interval estimation, Maximum likelihood estimation of parameters (Binomial, Poisson and Normal), Confidence intervals and related problems.

Module-IV: Testing of Hypothesis **[7L]**

Simple and Composite hypothesis, Critical region, Level of significance, Type I and Type II errors, one sample and two sample tests for means and proportions, $\chi 2$ - test for goodness of fit.

Text Books:

1. Probability and Statistics, Das, N.G., The McGraw Hill Companies.
2. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K., Sultan Chand & Sons.
3. Fundamental of Statistics, Goon A.M., Gupta M. K. and Dasgupta, B., The World Press Pvt. Ltd.
4. Advanced Engineering Mathematics,Kreyszig, E., 9thEdition; John Wiley & Sons, 2006.

Reference Books:

1. Schaum's Outline in Probability (2ndEd.), Lipschutz, S.and Lipson, M., McGraw Hill Education.
2. Fundamentals of Probability and Statistics for Engineers, Soong, T. T., Wiley Publications.
3. Theory and Problems of Probability and Statistics (Schaum's Outline Series), Spiegel, M. R., McGraw Hill Book Co.
4. Applied Statistics and Probability for Engineers, Montgomery, D.C. and Runger, G.C., Wiley Publications.

Paper name: Project Management and Finance

Code: HU(AM)401

Contact Hour-02 (L=02; T:0 P :0)

Number of Lectures:28

Course Objectives

1. To introduce students to the fundamental concepts and components of Project Management.

2. To develop the ability to perform preliminary project screening and appraisal, enabling students to identify viable project opportunities and assess their potential.

3. To provide knowledge and analytical skills for conducting comprehensive feasibility studies.

4. To impart foundational knowledge of Financial Management principles.

5. To enhance decision-making abilities related to financial management, particularly in areas such as investment analysis, cost control, and project financing.

Course Outcomes:

CO1: Understand and explain the fundamental principles, tools, and techniques of project management including planning, scheduling, monitoring, and control in engineering projects.

CO2: Apply project screening and feasibility analysis methods to assess the technical, market, and operational viability of engineering projects.

CO3: Analyze financial data to evaluate project investments, including concepts such as time value of money, break-even analysis, and risk-return trade-off.

CO4: Demonstrate decision-making capabilities in project financing and resource allocation, using basic financial management principles and tools.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	2	1	2	2	1
CO2	2	3	3	3	3	1	1	1	2	2	2
CO3	2	3	3	3	2	1	2	1	2	2	3
CO4	1	2	2	1	2	2	2	3	3	3	2

Course Content:

UNIT I: BASICS OF PROJECT MANAGEMENT: Meaning, Definition and scope and Need for Project Management - The Project Life Cycle - Phases of Project Management Life Cycle - Project Management Processes. **(2L)**

UNIT II: PROJECT IDENTIFICATION AND SELECTION: Preliminary Screening of Projects. Project Identification Process- Sources of Financial resources - Pre-Feasibility Study - Feasibility Studies: Market Feasibility, Financial Feasibility and Technical Feasibility (**3L)**

UNIT III: PROJECT ORGANIZATION AND PLANNING: Project manager, Cross-functional team, Dedicated project organization, Influence project organization, Matrix organization, Advantages and disadvantages of project organizations, Selection of project organization, Work Breakdown Structure (WBS), Integration of project organization and WBS, WBS and responsibility matrix. **(3L)**

UNIT IV: PROJECT SCHEDULING AND RESOURCE MANAGEMENT: Gant chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation. **(4L)**

UNIT-V: NATURE AND SCOPE OF FINANCIAL MANAGEMENT

Role of financial management in business decision, the Firm and its Environment: Forms of business ownership. **(2L)**

UNIT-VI: BALANCE SHEET AND PROFIT AND LOSS STATEMENTS

Tools of Financial Analysis: Funds flow analysis - sources and uses of funds, measurements of cash flow, Revenue costs. **(3L)**

Investment Management: Capital Budgeting Techniques. PBP, ARR, Time Value of Money, NPV v/s IRR. Risk Analysis. **(3L)**

UNIT-VII: PROFIT RELATIONSHIPS

Break even analysis, ratio analysis, of operating and financial leverages, Working Capital Management, Credit Policy. **(3L)**

Financial Decision Making: Sources of raising capital, Internal financing, Cost of capital, Balanced Capital Structure. Capital Structure Theories, Dividend Policy & its Theories. (**5L**)

Textbooks:

1. R. Paneerselvam, P. Senthil Kumar, Project Management, PHI.

2. S. N. Maheshwari, Financial Management: Principles andApplications ,Sultan Chand & Sons

Reference Books:

1. Prasanna Chandra, Projects, Planning, Analysis, Selection, Financing, Implementation and Review, Tata McGraw Hill Pvt. Ltd., New Delhi.

2. K. Nagrajan, Project Management, New Age International Publishers,

3. Vasanth Desai, Project Management, Himalaya Publications.

4. Clifford F. Gray, Erik W. Larson, Project Management, the Managerial Emphasis, Tata McGraw Hill.

6. 7. M.Y. Khan and P. K. Jain, Financial Management: Text, Problems and Cases, Tata McGraw Hill Pvt. Ltd., New Delhi.

Course Name: Database Management System Lab

Course Code: AM491

Credit: 1.5

Contact: 0:0:3

Prerequisites: 1. Logic of programming language

2. Basic concepts of data structure and algorithms

Course Objectives:

• This lab enables the students to practice the concepts learnt in the subject DBMS by developing

a database.

- The student is expected to practice the designing, developing and querying a database.
- Students are expected to use "Mysql/Oracle" database.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Demonstrate and explain the database management system and different database languages.
CO2	Understand and apply the SQL queries related to management of data and transaction processing for solving real life problems
CO3	Explain and analyze query processing techniques involved in query optimization.
CO4	Demonstrate and apply the PL/SQL programming, the concept of Cursor Management, Error Handling, Package and Triggers for solving real life complex problems.
CO5	Design and assess the commercial database systems.

CO-PO Mapping:

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

Course Content:

1. Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)
2. Converting ER Model to Relational Model (Represent entities and relationships in Tabular

form, Represent attributes as columns, identifying keys) and apply the normalization techniques.

3. Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables
4. Practicing DML commands- Insert, Select, Update, Delete
5. Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc., Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).
6. Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping, Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger.
7. Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure, PL/SQL, Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor

Course Name: Advanced Artificial Intelligence Lab

Course Code: AM492

Contact: 0:0:3

Credit: 1.5

Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Objective:

- To introduce PROLOG programming and its use in knowledge representation and inferencing for AI-based problem solving.
- To implement search algorithms (BFS, DFS, A*) and constraint satisfaction techniques for goal-oriented and puzzle-solving tasks.
- To develop and analyze AI applications using recursion, lists, decision-making strategies, and adversarial game-playing logic.
- To design and execute mini-projects demonstrating practical applications of AI concepts through structured implementation and documentation.

Course Outcomes(COs):

After attending the course students should be able to

CO1	Acquire foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and understand the working principle of the agent and assess its utilitarian importance in current technological context leading towards lifelong learning.
CO2	Identify and formulate an engineering problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence
CO3	Explore relevant literature and apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	Develop ideas and propose an expert system offering solutions to the challenging problems of Artificial Intelligence
CO5	Plan and Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies or expert systems with adequate documentation in collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	3	3	-	-

CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	3

Course Content:

1. **Introduction to PROLOG Programming along with the IDE and its Basic Components**

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy.

2. **Arithmetic, Boolean Expression, Decision Making Strategies**

   Assignments for understanding implementation of Arithmetic Expression, Boolean Expression, and Decision-Making Strategies.

3. **Recursion and Looping through Recursion**

   Assignments for understanding implementation of Recursion and Looping through Recursion.

4. **List of Data Items in PROLOG**

   Assignments for understanding the utility of List in solving various problems.

5. **Blind Search Techniques – BFS, DFS**

   Implementation of BFS and DFS Algorithms for Goal Searching to solve Puzzles (8-Puzzle, Water Jug Puzzle)

6. **Heuristic Search Techniques – A* Search**

   Implementation of A* Search Algorithm for Goal Searching to solve Puzzles (8-Puzzle, Route Finding Puzzle)

7. **Constraint Satisfaction Problem Solving**

   Implementation of Backtracking Strategies to solve Constraint Satisfaction Problems (Graph Coloring Problem, 8-Queens Problem)

8. **Game Playing**

Implementation of Adversarial Search Algorithm with alpha-beta pruning strategy for Game Playing (Tic-Tac-Toe)

9. **Discussion on Project Problems and Allocation (Problem Description Report Submission)**
10. **Designing Solution Model and Proposal Report Submission**
11. **Project Implementation, Verification and Documentation**
12. **Project Demonstration and Project Report Review**

Textbook:

1. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley

2. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall. 3. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.

2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill

Course Name: ADVANCED IT WORKSHOP(Python)

Course Code: AM493

Contact: 0:0:3

Credit: 1.5

Prerequisites: Knowledge of Mathematics and basic concepts of Programming

- Basic knowledge of programming concepts (variables, loops, conditionals, functions).

- Familiarity with Core Python (data types, OOP basics, exception handling, file handling).
-
- Basic understanding of data structures (lists, stacks, queues, trees, graphs).

Course Objective(s):

The objectives of this course are to:

1. Equip students with advanced features of Python for real-world applications.
2. Introduce Python libraries and frameworks for data processing, visualization, and automation.
3. Develop problem-solving skills using Python in areas like database handling, networking, and web development.
4. Enhance the ability to integrate Python in data science, AI/ML, and big data environments.

Course Outcomes(COs):

After attending the course students should be able to

CO1	Apply advanced Python features (iterators, generators, decorators, context managers) for efficient programming.
CO2	Utilize Python libraries (NumPy, Pandas, Matplotlib) for data analysis and visualization.
CO3	Implement database programming, file handling, and networking applications using Python.
CO4	Develop Python-based applications in domains like web frameworks, automation, and machine learning.
CO5	Integrate Python with big data and emerging technologies for scalable applications.

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	2	3	-	-	-	-	-	2	3	2	-
CO2	3	3	2	3	3	-	-	1	1	-	3	2	3	2

CO3	3	2	2	2	3	-	-	1	1	2	2	3	2	2
CO4	3	3	3	2	3	1	-	2	2	2	3	2	3	2
CO5	3	3	2	2	3	1	-	2	1	3	3	2	3	3

CO-PO Mapping:

Course Content:

Module 1: Advanced Python Fundamentals

- Iterators, Generators, Decorators, Context Managers
- Exception Handling (advanced)
- File handling (JSON, CSV, XML, Pickle, HDF5)

Module 2: Data Handling and Visualization

- NumPy arrays, operations, broadcasting
- Pandas: Series, DataFrame, indexing, grouping, merging
- Matplotlib & Seaborn: plots, subplots, advanced visualization

Module 3: Python for Database & Networking

- SQLite, MySQL with Python
- CRUD operations with databases
- Python socket programming
- REST API basics and requests module

Module 4: Python for Web and Automation

- Flask/Django basics for web applications
- Web scraping with BeautifulSoup, Selenium
- Regular expressions, Automation scripts

Module 5: Python for Machine Learning and Big Data

- Scikit-learn basics (classification, regression, clustering)
- Introduction to TensorFlow / PyTorch
- Big Data integration (PySpark, Hadoop streaming with Python)
- Cloud & IoT integration (overview)

Module 6: Case Studies & Mini Project

- Real-world case study on data analytics / ML / automation
- Mini project using advanced Python concepts

Textbook

1. **Mark Lutz** – *Learning Python*, O'Reilly Media.
2. **Wes McKinney** – *Python for Data Analysis*, O'Reilly Media.

Reference Books

1. **Fluent Python** by Luciano Ramalho, O'Reilly.
2. **Python Cookbook** by David Beazley and Brian K. Jones, O'Reilly.
3. **Introduction to Machine Learning with Python** by Andreas Müller & Sarah Guido, O'Reilly.
4. **Programming Python** by Mark Lutz, O'Reilly.

PAPERNAME:SOFTSKILLANDAPTITUDE
PAPER CODE: HU(AM)491
CONTACT:0:0:2
CREDIT:1

Prerequisite: Basicability of soft skills.

Course Outcome: After completion of this course students will be able to:

CO1: Identify, define, apply workplace interpersonal communication modalities in an effective manner.

CO2: Employ, infer, and relate group behavioral and personal interview skills.

CO3: Organize, differentiate, employ reading proficiency skills.

CO4: Identify, classify, organize and relate question types and aptitude test patterns in placement tests.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	2	2	1	3	2	3	-	3
CO2	3	2	2	-	2	1	-	3	3	3	-	3
CO3	3	-	-	-	2	-	-	-	-	3	2	3

CO4	3	3	1	1	3	-	-	-	3	3	3	3

Course Content:

Module 1:–Introduction to Soft Skills
1. The Skills of Interpersonal Communication. 2. Team Behavior.3.Time Management Skills 4. Developing public speaking abilities through various assignments--- Self Introduction, Creation of Video Resume

Module 2-VerbalAbility:Reading and Verbal Ability Test Patterns
Enhancing reading speed and vocabulary enhancement through intensive practice of placement test-based reading passages.
Introducing Verbal Ability tests—Test Question Types: Synonyms and Antonyms, Error Spotting /Sentence Improvement, Analogies and Para Jumbles

Module 3– Presentation Skills

Kinds of Presentation. Presentation techniques, planning the presentation,

Structure of presentation: Preparation, Evidence and Research, Delivering the presentation, handling questions,

Time management and Visual aids.

Assignments: Both macro and micro Power Point Presentation.

Module 4–GroupDiscussion and Personal Interview.
Basics of Group Discussion—Intensive practice on answering interview-based questions common in placement interviews.

List of recommended Books:

- Meenakshi Raman and Sangeetha Sharma. Technical Communication.3rd Edition. New Delhi: Oxford University Press, 2015.
- Mark Ibbotson. Cambridge English for Engineering. Cambridge: Cambridge UniversityPress,2008.
- Mark Ibbotson. Professional English in Use: Engineering. Cambridge, 2009.
- John Seeley. Writing Reports. Oxford: Oxford University Press, 2002.
- Diana Booher. E-writing: 21st Century Tools for Effective Communication. Macmillan, 2007.

Michael Swan. Practical English Usage. Oxford: OUP, 1980.

Course Name: Research Methodology& IPR

Course Code:AM481

Contact: 1:2:0

Total Contact Hours: 36L

Credits: 2

Pre requisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Outcomes (COs):

After attending the course students should be able to

CO1	Define and understand the motivation and objectives of research work
CO2	Explain how to define and formulate a research problem
CO3	Identify the importance of literature review in a research work.
CO4	Examine the appropriate statistical methods required for a particular research design and develop the appropriate research hypothesis fora research project
CO5	Explain the ethical issues involved while undertaking research
CO6	Develop the skill set to correctly present a research work by following the protocols of writing a standard Research report.

CO-PO Mapping:

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

Course Content:

Module – 1RESEARCH FORMULATION AND DESIGN[9L]

Motivation and objectives –Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity

of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review,identifying gap areas from literature and research database, development of working hypothesis.

Module –2 DATA COLLECTION AND ANALYSIS[9L]

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods,data processing and analysis strategies and tools, data analysis With statically package(SigmaSTAT,SPSSforstudentt-test,ANOVA,etc.),hypothesistesting.

Module – 3RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING[9L]

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights(TRIPS);scholarly publishing-IMRAD concept and Design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability

Module 4 INTERPRETATION AND REPORT WRITING[9L]

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.

3RD YEAR 5TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM501	**MACHINE LEARNING**	3	0	0	3	3
2	ENGG	MAJOR	AM502	**SOFTWARE ENGINEERING**	3	0	0	3	3
3	ENGG	MAJOR	AM503	**NATURAL LANGUAGE PROCESSING**	3	0	0	3	3
3	ENGG	MAJOR	AM504A	**CRYPTOGRAPHY & NETWORK SECURITY**	3	0	0	3	3
			AM504B	**INTERNET OF THINGS**					
			AM504C	**COMPUTER GRAPHICS**					
5	ENGG	MAJOR	AM505	**COMPUTER NETWORKS**	3	0	0	3	3
B. PRACTICAL									
1	ENGG	MAJOR	AM591	**MACHINE LEARNING LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM592	**SOFTWARE ENGINEERING LAB**	0	0	3	3	1.5
3	ENGG	MAJOR	AM593	**NATURAL LANGUAGE PROCESSING LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM581	**PROJECT- I**	0	0	2	2	2
2	ENGG	INTERNSHIP	AM582	**INDUSTRIAL INTERNSHIP**	0	0	2	2	1.5
Total of Theory, Practical								**27**	**23**

Course Name: Machine Learning

Course Code:AM501

Contact: 3:0:0

Total Contact Hours: 48L

Credit: 3

Prerequisites:

1. Data Structure,
2. Design and Analysis of Algorithms,
3. Statistics,
4. Artificial Intelligence

Course Objective(s):

The objective of the course is to make the students able to –

1. Comprehend the fundamental concepts of the evolving technologies in machine learning such as Supervised and Unsupervised Learning
2. Formulate an engineering problem within the scope of machine learning paradigm.
3. Apply the concepts of machine learning to solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning.
5. Analyze the effectiveness of various machine learning Frameworks.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** the basic concepts of machine learning to **explain or illustrate** and**Identify**problems where students can **apply** the concept appropriately to **Solve**them.
CO2	**Understand** the fundamental concepts of regression analysis so that they can **propose**

	models for predicting values based on exemplary data and **analyze**their performances.
CO3	**Explain or illustrate** the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **analyze**their performances.
CO4	**Explain or illustrate** the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **analyze**their performances.
CO5	**Develop** ideas to **propose** solutions to the problems of supervised learning and **Identify** problems where students can **Apply** the concept appropriately and **Analyze**the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction to Machine Learning (4L) Basic Concepts, Various types of Machine Learning Techniques and related applications, Issues in Machine Learning Strategies, Data Exploration for Machine Learning: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Similarity Measures; Data Pre-processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation & Discretization.

Module 2: Classification and Regression (14L) Basic Concepts, assessing and visualizing performance of classification, k-Nearest- Neighbor Classifier, Decision Tree Classifier, Naïve Bayes Classifier; Ensemble Classification, Random Forest Strategy, Linear and Nonlinear Regression Methods and their performance analysis.

Module 3: Clustering, Association and Outlier Analysis (10L) Basic Concepts, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density; Outlier Analysis.

Module 4: Mining Frequent Patterns, Associations and Data Streams (3L) Basic Concepts, Association analysis and Frequent Itemset Mining Methods: The Apriori Algorithm, Mining Time Series Data.

Module 5: Advanced Concepts (5L) Introduction to advanced concepts of machine learning like Support Vector Machines and Artificial Neural Network and their applications in solving machine learning problems.

Text book:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007
2. Machine Learning, Dr. Rajiv Chopra, Khanna Publishing House, 2018
3. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.

Reference Books:

1. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley.
2. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, AurélienGéron, O'Reilly.
3. Data Mining: Concepts and Techniques, Han J &Kamber M, , Morgan Kaufmann Publishers, Third Edition.

Course Name: Software Engineering

Course Code:AM502

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites:

1. Programming for Problem Solving

Course Objective(s):

The objective of the course is to make the students able to –

1. To understand the working environment in industry and aware of cultural diversity, who conduct themselves ethically and professionally.

2. Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** the basic concept of Software Engineering and mathematical knowledge and **apply** them in designing solution to engineering problem including he specification, **design**, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2	**Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3	**Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CO4	**Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice team work.
CO5	**Identify** and **Use** modern engineering tools necessary for software project management time management and software reuse, and an ability to engage in life- long learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction (6L) Software Engineering, Characteristics, Components, Application, Definitions. Software Project Planning-Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, Basics of Estimation: COCOMO [Basic, intermediate, Complete] model.

Module 2: Software life cycle models (6L) Evolution and impact of Software engineering, software life cycle models Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non- functional requirements, Requirements gathering, Requirements analysis and specification.

Module 3: Software design (8L) Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.

Module 4: Software Testing (7L) Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling.

Module 5: Software project management (9L) Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

Text book:

1. Fundamentals of Software Engineering , Rajib Mall, –PHI-3rd Edition, 2009.
2. Software Engineering, Pankaj Jalote, Wiley-India.

Reference Books:

1. Software Engineering, by Agarwal and Agarwal [PHI]
2. Software Engineering, by Ian Sommerville, Pearson Education Inc., New Delhi, 2009.
3. Software Engineering: A Practitioner's Approach, by Roger S. Pressman, McGraw-Hill, 2005.

Course Name: Natural Language Processing

Course Code: AM503

Contact: 3:0:0

Total Contact Hours: 36 L

Credit: 3

Prerequisites: Statistics, Automata, Compiler Design.

Course Objective(s):

The objective of the course is to make the students able to –

1. To learn the basics and details of NLP algorithms, principles & application, different NLP techniques and different tools and their uses.
2. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
3. To learn the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to Propose models for Word Prediction & Disambiguation.
4. To learn the concepts of Markov Model for POS Tagging and Probabilistic Context Free Grammars and Probabilistic parsing.
5. To learn the techniques of Syntax & Semantics Analysis for Machine Translation and Identify problems where students can Apply the concept appropriately.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand the basic concepts of NLP to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Text Pre-processing and Morphology so that they can Apply the concept to Analyze their CORPUS.
CO3	Explain or illustrate the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to Propose models for Word Prediction & Disambiguation and Evaluate their performances.
CO4	Explain or illustrate the concepts of Markov Model for POS Tagging and Probabilistic Context Free Grammars and Probabilistic parsing so that they can Apply them to solve the

	relevant problems and analyze their performances.
CO5	Develop ideas to Propose solutions to the problems of Syntax & Semantics Analysis for Machine Translation and Identify problems where students can Apply the concept appropriately and analyze the effectiveness as well as limitations of solutions underscoring the utilitarian importance for further exploration of NLP issues leading towards lifelong learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction to NLP (4L) Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation

Module 2: Text Pre-processing and Morphology (5L) Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.

Module 3: Language Modeling (4L) Introduction to N-grams, Chain Rule, Smoothing - Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models.

Module 4: Word Sense Disambiguation (5L) Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An in-formation theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus.

Module 5: Markov Model and POS Tagging (5L) Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging.

Module VI: Probabilistic Context Free Grammars and Probabilistic parsing (5L) The Probability of a String, Problems with the Inside-Outside Algorithm, Parsing for disambiguation, Treebanks, Parsing models vs. language models, Phrase structure grammars and dependency, Lexicalized models using derivational histories, Dependency-based models.

Module VII: Syntax & Semantics Analysis and Machine Translation (8L) Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction, Text mining, Information Retrieval, NL interfaces, Sentimental Analysis, Question Answering Systems, Social network analysis.

Text book:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education.
2. Foundation of Statistical Natural Language Processing, Manning andSchutze, MIT Press.
3. Multilingual Natural Language Processing Applications from Theory to Practice: Pearson.
4. Natural Language Processing, by Ela Kumar, Wiley.

Reference Books:

1. Natural Language Understanding, by Allen, James. Benjamin/Cummings, 2nd Ed. 1995.
2. Natural Language Processing- "A Paninian Perspective", Bharathi, A., Vineet Chaitanya and Rajeev Sangal, Prentice Hll India, Eastern Economy Edition, 1995.
3. Natural language processing in action, Hobson lane, Cole Howard, Hannes Hapke, MANNING Publications, 2019.

Course Name: Cryptography and Network Security

Course Code: AM504A

Contact: 3 : 0 : 0

Total Contact Hours: 36L

Credit: 3

Prerequisites:

The student must have basic knowledge about Computer Network and mathematics.

Course Objective(s):

The objective of the course is to make the students able to –

1. To provide introduction to the concept of Network Security Model and Cryptography systems.
2. To give the knowledge of Digital Signature and other Security Measures available.
3. To familiarize with the various techniques like PGP and S/MIME.
4. To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
5. To explain the firewall design principles and various intrusion detection system.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand cryptography and network security concepts and application.
CO2	Apply security principles to system design.
CO3	Identify and investigate network security threat
CO4	Analyze and design network security protocols.
CO5	Develop ideas to Propose solutions to the problems of network security and Identify problems where students can Apply the concept appropriately and analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	3	3

Course Content:

Module 1: Introduction (7L) Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model, Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques steganography) Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm.

Module 2: Data Encryption & Key [9L] Data Encryption Standard- Block cipher principles, block cipher modes of operation, Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm, Public key cryptography: Principles of public key cryptosystems, The RSA algorithm, Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography.

Module 3: Authentication (6L) Authentication requirement, Authentication function, MAC, Hash function, Security of hash function and MAC, MD5, SHA, HMAC, CMAC, Digital signature and authentication protocols, DSS, ElGamal, Schnorr.

Module 4: Internet Firewalls & Malware (7L) Authentication applications, Kerberos, X.509, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles, SET for E-Commerce Transactions, Intruder, Intrusion detection system, Virus and related threats, Countermeasures, Trusted systems, Practical implementation of cryptography and security.

Module 5: E-Mail & IP Security (7L) E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source, Message Integrity, Non- repudiation, Pretty Good Privacy, S/MIME, IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP), Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding), Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication, PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction.

Text book:

1. Cryptography and network security, by Kahate, Tata McGraw-Hill Education.

2. Cryptography and network security, by Forouzan & Mukhopadhyay, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Cryptography and network security, Stallings, W. 4/E. Pearson Education India,2006.
2. Computation, cryptography, and network security, Daras, N. J., &Rassias, M. T.. (pp. 253- 287). Springer, 2015
3. Cryptography and network security, Kumar, A., & Bose, S.. Pearson Education India, 2017.

Course Name: Internet of Things

Course Code: AM504B

Contact: 3 : 0 : 0

Total Contact Hours: 36L

Credit: 3

Prerequisites:

1.Fundamental knowledge in computer networking.
2.Basic knowledge of Microcontroller fundamentals.

Course Objective(s):

The objective of the course is to make the students able to understand the concepts of Internet of Things and be able to build IoT applications.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand and differentiate the fundamental concepts of Internet of Things and the Internet.
CO2	Demonstrate the concepts of wireless sensor network, Analyze and Identify appropriate
CO3	Analyze and compare the basic protocols used in different OSI layer of wireless sensor network and IoT.
CO4	Describe IoT architecture and Machine to machine communication.
CO5	Design basic IoT applications and solve different real-life problems in different domains bas upon

	the concept of IoT and sensor network.

CO-PO Mapping:

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

Course Content:

Module 1: Wireless Sensor Network (9L) Wireless sensor network, application of it, sensor nodes, Network & Communication aspec Wireless medium access issues, MAC protocol, routing protocols, Sensor deployment & No discovery, Data aggregation & dissemination.

Module 2: Fundamental of IoT (4L) The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Thin Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Intern Technologies, Infrastructure, Networks and Communication, Design challenges, Developme challenges, Security challenges, other challenges.

Module 3: IoT and M2M (7L) A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chai An emerging industrial structure for IoT, The international driven global value chain a global information monopolies. M2M to IoT-An Architectural Overview– Building architecture, Main design principles and needed capabilities, An IoT architecture outline standards considerations.

Module 4: IoT Architecture (7L) Introduction, ArchitectureReference Model- Introduction, Reference Model and architecture IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Informati View, Deployment and Operational View, Other Relevant architectural views.

Module 5: IoT Applications for Value Creations (5L) Introduction to Arduino and Raspberry Pi, Cloud Computing, Fog Computing, Connect Vehicles, Data Aggregation for the IoT in Smart Cities,Introduction, IoT applications of industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Fo Aspects in your Business to Master

IoT, Value Creation from Big Data and Serialization, IoT health care, Value for Industry, smart home Management.

Module-6: Internet of Things Privacy, Security and Governance (4L) Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Da Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Da Aggregation for the IoT in smart cities, Security. Data analytics in IoT.

Text book:

1. Internet of Things (A Hands-on-Approach), by Vijay Madisetti and Arshdeep Bahga, VPT, 1st Edition, 2014.
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis da Costa, Apress Publications, 1 Edition, 2013.

Reference Books:

1. Getting Started with the Internet of Things, Cuno Pfister, OReilly Media, 2011, ISBN: 978-1-4493-9357-1
2. Fundamentals of Wireless Sensor Networks: Theory and Practice, Waltenegus Dargie, Christian Poellabauer.

Course Name: Computer Graphics

Course Code: AM504C

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites:

Mathematics, Computer Fundamentals & Principle of Computer Programming.

Course Objective(s):

The objective of the course is to make the students able to –

1. The objectives of this course are to enable students to Use of the component so fa graphics system and become familiar with building approach of graphics system components and algorithms related with them.

2. Understand the basic principles of 2D and 3D computer graphics.
3. Understand of how to scan convert the basic geometrical primitives, how to transform the shapes to fit the master the picture definition.
4. Understand the mapping from a world co-ordinate to device co-ordinates, clipping, and projections.
5. Discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand t**he fundamental concept of Computer graphics and mathematical knowledge and explain the foundations of computer graphics and different display technology and devices.
CO2	**Demonstrate** different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools.
CO3	**Understand** the basic concept of graphics programming and implement clipping with the comprehension of windows, view-port scene relation to images displays on screen.
CO4	**Analyze**and compare different drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms hidden surface illumination methods.
CO5	**Develop** the concept of geometric models, mathematical and algorithmic approach necessary for programming computer graphics leading to lifelong learning.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	3	-	3

CO3	-	2	3	2	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	3	3

Course Content:

Module 1: Introduction (4L) Introduction: Objective, applications, GKS/PHIGS, normalized co-ordinate system, aspect ratio.

Module 2: Computer Graphics System (4L) Graphics System: Vector and raster graphics, various graphics display devices, graphics interactive devices, segmented graphics, attribute table.

Module 3: Computer Graphics System (4L) Raster Scan Graphics: Line drawing algorithms, circle/ellipse drawing algorithms, polygon filling algorithms.

Module 4: Geometric Transformation (4L) Geometric Transformation: Homogeneous co-ordinate system, 2D and 3D transformations, projection— orthographic and perspective.

Module 5: Curves and Surfaces (4L) Curves and Surfaces: Curve approximation and interpolation, Lagrange, Hermite, Bezier and B Spline curves/surfaces and their properties, curves and surface drawing algorithms.

Module 6: Curves and Surfaces 2 (4L) Geometric modelling: 3D object representation and its criteria, edge/vertex list, constructive solid geometry, wire-frame model, generalized cylinder, finite element methods.

Module 7: Viewing and Clipping (4L) Clipping: Window and viewport, 2D and 3D clipping algorithms.

Module 8: Hidden Surfaces (4L) Hidden Lines and Hidden Surfaces: Concept of object- and image-space methods, lines and surface removal algorithms.

Module 9: Illumination and Color models (4L) Intensify, Coloring and Rendering: RGB, YIQ, HLS and HSV models and their conversions, gamma correction, half toning. Illumination models, polygon mesh shading, transparency, shadow, texture.

Text book:

1. Computer Graphics, by D. Hearn and P. M. Baker, 2nd ed. Prentice Hall of India, New Delhi, 1997.

2. Principles of Interactive Computer Graphics, by W. M. Newman and R. F. Sproull, McGraw Hill,

New Delhi, 1979.

Reference Books:

1. Computer Graphics, by F. S. Hill: McMillan, New York, 1990.
2. Fundamentals of Computer Graphics and Multimedia, by D. P. Mukherjee, Prentice Hall of India, New Delhi, 1999.
3. Computer Graphics, by J. D. Foley et al., 2nd ed., Addison-Wesley, Reading, Mass., 1993.
4. Interactive Computer Graphics: Data Structure, Algorithms, Languages, by W. K. Giloi, Prentice Hall, Englewood Cliffs, 1978.

Course Name: Computer Networks

Course Code: AM505

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites:

1. Familiarity and knowledge of Operating Systems and Computer Architecture.
2. Also require a little bit of programming languages concepts like C, Java.

Course Objective(s):

The objective of the course is to make the students able to –

1. To be familiar with the basics of data communication
2. To be familiar with various types of computer networks
3. To have experience in designing communication protocols
4. To be exposed to the TCP/IP protocol suite

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand OSI and TCP/IP models
CO2	Analyze MAC layer protocols and LAN technologies.
CO3	Design applications using internet protocols.
CO4	Implement routing and congestion control algorithms.
CO5	Develop application layer protocols and understand socket programming.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction (6L) Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network. Physical Layer: [3L] Overview of data (analog& digital), signal (analog& digital), transmission (analog& digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network.

Module 2: Data Link Layer (10L) Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop- andWait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go- Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. [5L]

Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, IEEE

802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching. [5L]

Module 3: Network Layer (10L) IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP– Delivery protocols Other Protocols such as mobile IP in wireless Network. [5L] Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing: RIP, OSPF, BGP; Routing forMobile Hosts. [5L]

Module 4: Transport layer: (6L) Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. [5L] Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. [1L]

Module 5: Application Layer (3L) Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Module-6: Socket Programming (1L) Introduction to Socket Programming, UDP socket and TCP Socket.

Textbook:

1. Data Communications and Networking, by B. A. Forouzan,3rd Ed., TMH
2. Computer Networks, by S. Tanenbaum, 4th Ed., Pearson Education/PHI
3. Data and Computer Communications, by W. Stallings, 5th Ed. PHI/ Pearson Education
4. Network for Computer Scientists & Engineers, Zheng & Akhtar, OUP

Reference Books:

1. Computer Networking -A top-down approach featuring the internet, Kurose and Rose, Pearson Education
2. Communication Networks, Leon, Garica,Widjaja, TMH
3. Communication Networks, by Walrand, TMH.

Internetworking with TCP/IP, Comer, 4th Ed., Pearson Education/PHI

Course Name: Machine Learning Lab

Course Code: AM591

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics, Artificial Intelligence, Python Programming

Course Objective(s):

The objective of the course is to make the students able to –

1. Comprehend and implement the fundamental concepts of the evolving technologies in machine learning such as Supervised and Unsupervised Learning
2. Formulate an engineering problem within the scope of machine learning paradigm.
3. Implement the concepts of machine learning to solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning.
5. Analyze the effectiveness of various machine learning frameworks using appropriate tools.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** and **implemen**t the basics concepts of machine learning to**explain or illustrate** and **identify** problems where students can **apply** the concept appropriately to **solve** them.
CO2	**Understand** and **implemen**t the fundamental concepts of regression analysis so that they can **propose models** for predicting values based on exemplary data and **analyze**their performances.
CO3	**Understand** and **implemen**t the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **analyze**their performances.
CO4	**Understand** and **implemen**t the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **analyze**their performances.
CO5	**Develop** ideas to **propose** solutions to the problems of supervised learning and **identify** problems where students can **apply** and **implement** the concept appropriately with adequate documentation in collaborative environment for successfully carrying out projects on

	machine learning problems and **investigate** their effectiveness by **analyzing**the performances using proper techniques and tools and **assess** the limitations of solutions underscoringutilitarian importance for further explorations leading towards lifelong learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction (3L) Introduction to Machine Learning Programming Platform& Python Programming Basics, Introduction to Machine Learning Programming Platform and Python Programming Basics

Module 2: Data Exploration (3L) Data Exploration: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Feature Vectors, Data Preprocessing: Data Cleaning, Data Transformation

Module 3: Regression (3L) Implementation and Analysis of Linear and Nonlinear Regression Methods.

Module 4: Classification (3L) Implementation and Analysis of k-Nearest-Neighbor Classifier, Decision Tree Classifier.

Module 5: Classification (3L) Naïve Bayes Classifier, Implementation and Analysis of ANN-Backpropagation and SVM Based Classifier.

Module 6: Clustering (3L) Implementation and Analysis of k-Means and k-Medoids

Module 7: Association Analysis (3L) Implementation and Analysis of Apriori Algorithm

Module 8: Mining Time-Series Data (3L) Implementation and Analysis of Time-Series Data Mining Models

Module 9: Discussion on Project Problems and Allocation(3L) Problem Description Report Submission.

Module 10: Designing Solution Model and Proposal Report Submission (3L)

Module 11: Project Implementation, Verification and Documentation (3L)

Module 12: Project Demonstration and Project Report Review (3L)

Text book:

1. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly
2. Pattern Recognition and Machine Learning, by Christopher Bishop, Springer, 2007
3. Machine Learning, by Dr. Rajiv Chopra, Khanna Publishing House, 2018

Reference Books:

1. Machine Learning, by Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley.

Course Name: Software Engineering Lab

Course Code: AM592

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites: Programming for Problem Solving.

Course Objective(s):

The objective of the course is to make the students able to –

1. 1.To learn software development skill through various stages of software life cycle.

2. To ensure the quality of software through software development with various protocol- based environment.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** the basic concept of Software Engineering and mathematical knowledge and **apply** them in designing solution to engineering problem including he specification, **design**, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2	**Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3	**Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CO4	**Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice team work.
CO5	**Identify** and **Use** modern engineering tools necessary for software project management time management and software reuse, and an ability to engage in life-long learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction (6L) Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system). DFD of standard application problems.

Module 2: Software life cycle models (6L) Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Estimation of project size using Function Point (FP) for calculation.

Module 3: Software design (6L) Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose. (For standard application problems)

Module 4: Software Coding& Testing (9L) Software Development, Coding Practice and Debugging, Design Test Script/Test Plan (both Black box and White Box approach)

Module 5: Software project management (9L) Software project management, Project planning and control, configuration control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations using standard tools.

Text book:

1. Fundamentals of Software Engineering by Rajib Mall, –PHI-3rd Edition, 2009.
2. Software Engineering-Pankaj Jalote (Wiley-India)

Reference Books:

1. Software Engineering–Agarwal and Agarwal (PHI)
2. Software Engineering, by Ian Sommerville, Pearson Education Inc., New Delhi. (2009).
3. Software Engineering: A Practitioner's Approach", by Roger S. Pressman, McGraw-Hill. (2005)

Course Name: Natural Language Processing Lab

Course Code: AM593

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites: Statistics, Automata, Compiler Design, Python Programming.

Course Objective(s):

The objective of the course is to make the students able to –

1. To learn the principles of NLP through implementation.
2. To build an application using different algorithms and natural language processing techniques.
3. To learn techniques of Machine translations.
4. To implement the NLP algorithms for extracting meaning of sentences
5. To understand and evaluate expert systems for various NLP problems with moderate complexity

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Analyze text corpora and lexical resources and pre-process of raw text.
CO2	Apply the concepts of Markov Model for POS Tagging to write structured programs for categorizing and tagging of words, segmentation of sentences.
CO3	Classify text and extract information from it.
CO4	Implement the relevant algorithms to analyze meaning of sentences for translating linguistic data.
CO5	Design and Implement expert systems for various NLP problems with adequate documentation in collaborative environment for successfully carrying out projects on NLP Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools and assess the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction (3L) Introduction to NLP Programming Platform & Python ProgrammingBasics Introduction to NLP Programming Platform and Python Programming Basics

Module 2: Morphological Processing (3L) Word Analysis and Morphological Processing Implementation of concepts for Word Analysis and Morphological Processing

Module 3: N-Gram Modelling (3L) N-Gram Modelling for Spelling and Word Prediction Implementation of concepts for Spelling and Word Prediction

Module 4: POS Tagging (3L) Hidden Markov Model Implementation and Analysis of Hidden Markov Model

Module 5: POS Tagging (3L) Viterbi Decoding Implementation and Analysis of Viterbi Decoding for POS Tagging.

Module 6: Semantic Processing & Sentiment Analysis (3L) Semantic Processing & Sentiment Analysis Implementation and Analysis of Semantic Processing and Sentiment Analysis strategies.

Module 7: Automatic Query Processing (3L) Automatic Query Processing System Implementation and Analysis of automatic query processing system.

Module 8: NLP based information retrieval Implementation and Analysis (3L) NLP based information retrieval Implementation and Analysis of NLP based information retrieval models.

Module 9: Discussion on Project Problems and Allocation (3L) Problem Description Report Submission.

Module 10: Designing Solution Model and Proposal Report Submission (3L)

Module 11: Project Implementation, Verification and Documentation (3L)

Module 12: Project Demonstration and Project Report Review (3L)

Text book:

1. Natural Language Processing with Python, by Steven Bird, Ewan Klein, and Edward Loper. O'Reilly.
2. Practical Natural Language Processing, by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, O'Reilly.

Reference Books:

1. Practical Natural Language Processing with Python, Sri Mathangi, Apress. 2.
2. Hands-On Natural Language Processing with Python, by Rajesh Arumugam, Rajalingappaa Shanmugamani, O'Reilly

Natural Language Toolkit documentation (https://www.nltk.org/), Natural Language Processing Lab (https://nlp-iiith.vlabs.ac.in/)

3RD YEAR 6TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM601	**NEURAL NETWORK AND DEEP LEARNING**	3	0	0	3	3
2	ENGG	MAJOR	AM602	**DIGITAL IMAGE PROCESSING**	3	0	0	3	3
3	ENGG	MAJOR	AM603	**CLOUD COMPUTING**	3	0	0	3	3
4	ENGG	MAJOR	AM604A	**MOBILE COMPUTING**	3	0	0	3	3
			AM604B	**QUANTUM COMPUTING**					
			AM604C	**PARALLEL COMPUTING**					
			AM604D	**DATA MINING AND DATA WAREHOUSING**					
5	HUM	MINOR	HU(AM)601	**CYBER LAW AND ETHICS**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM691	**NEURAL NETWORK AND DEEP LEARNING LAB**	0	0	3	3	1.5
2	ENGG	MAJOR	AM692	**DIGITAL IMAGE PROCESSING LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM681	**PROJECT- II**	0	0	4	4	4
Total of Theory, Practical								**24**	**21**
TOTAL THIRD YEAR CREDIT									**43**

Course Name: Neural Network and Deep Learning

Course Code: AM601

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: Thestudentstowhomthiscoursewillbe offered musthavetheconcept of Linear Algebra, DSP, PDE will be helpful.

Course Objective(s):

The objective of the course is to make the students able to –

1. Thestudentstowhomthiscoursewillbe offered musthavetheconcept of Linear Algebra, DSP, PDE will be helpful.
2. The course also includes implementation of neural components and as well as applying deep learning on real-world data sets using modern deep learning packages.
3. The course aims to understand how to evaluate models generated from data.
4. The course enables students to apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** the main fundamentals that drive Deep Learning.
CO2	**Understand** the key features in a neural network's architecture.
CO3	**Understand** and acquire the knowledge of applying Deep Learning techniques to solve various real-life problems.
CO4	Be able to build, train and **apply** fully connected deep neural networks.
CO5	**Develop** Inferencing Models for proposing solutions to the problems of neural network's architecture.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3									3	3	3
CO 2	3	3	3								3	3	2	3
CO 3	3	3	3									3	3	1
CO 4	3	3	3					3				3	2	3
CO 5	3	3	3					3	2			3	2	3

Course Content:

Module 1: Introduction to Neural Network: [8L]

Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network. Back Propagation Learning, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Module 2: Learning Models: [6L]

Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning series.

Module 3: Introduction to Deep Learning: [4L]

Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss.

Module 4: Deep Learning Models: [8L]

Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc. LSTM Networks.

Module 5: Optimization Problem [10L]

Optimization Techniques, Gradient Descent, Batch Optimization, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

Text book:

1. Deep Learning, Goodfellow, I., Bengio, Y., and Courville, A., MIT Press, 2016.
2. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Deep Learning, Rajiv Chopra, Khanna Publishing House, 1st Edition, 2018
2. Pattern Classification, Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc., 2nd Edition, 2001
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 1st Edition, 2004
4. Pattern Classification, Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc., 2nd Edition, 2001
5. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 1st Edition, 2004

Course Name: Digital Image Processing

Course Code: AM602

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: Design and Analysis of Algorithms, UG Level Mathematics

Course Objective(s):

The objective of the course is to make the students able to –

1. Understand the basic concepts of digital image processing and identify problems where students can apply the concept appropriately.
2. Understand the fundamental concepts of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
3. Illustrate the fundamental image restoration strategies and apply them appropriately to

eliminate noise in the image.
4. Illustrate various Image Compression Techniques and Analyze their performances.
5. Understand the ideas of Morphological Image Processing and Image Segmentation to propose solutions to the related problems and analyze the effectiveness as well as limitations of solutions underscoring its utilitarian importance for further explorations leading towards lifelong learning.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand** the basic concepts of digital image processing to Explain or Illustrate and Identify problems where students can apply the concept appropriately to solve them.
CO2	**Understand** the fundamental concepts of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
CO3	**Illustrate** the fundamental image restoration strategies and apply them appropriately to eliminate noise in the image.
CO4	**Illustrate** various Image Compression Techniques and apply them to compress the images and analyze their performances.
CO5	**Understand** and develop ideas to propose solutions to the problems of Morphological Image Processing and Image Segmentation and analyze the effectiveness as well as limitations of solutions under scoring its utilitarian importance for further explorations. leading towards lifelong learning.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3									3	3	3
CO 2	3	3	3								3	3	2	3
CO 3	3	3	3									3	3	1
CO 4	3	3	3					3				3	2	3
CO 5	3	3	3					3	2			3	2	3

Course Content:

Module 1: Introduction to Digital Image Processing [3L]

Applications of digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, Some Basic Relationships Between Pixels- Neighbours and Connectivity of pixels in image, Colour Image Models.

Module 2: Image Enhancement [10L]

Image Enhancement in The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT) and its relation with image characterization, fundamental steps of image enhancement in Frequency Domain, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

Module 3: Dynamics and Statics of Manipulators [8L]

Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough- Stewart platform, Singularity analysis and statics. Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators.

Module 4: Trajectory Planning and Control of Manipulators [9L]

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model-based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.

Module 5: Wheeled Mobile Robots and Advanced Mechanisms [5L]

Introduction and some well-known wheeled mobile robots (WMR), two and three- wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using MATLAB and ADAMS. Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough- Stewart platform and its

singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform-based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).

Text book:

1. Digital Image Processing, Rafael C. Gonzales, Richard E. Woods, Third Edition, Pearson Education, 2010.
2. Digital Image Processing, S. Sridhar, Oxford University Press, 2nd Ed, 2016.

Reference Books:

1. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
2. Image Processing, analysis and Machine Vision, Milan Sonka, Thomson Press India Ltd, Fourth Edition.

Course Name: Cloud Computing

Course Code: AM603

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: The student must have basic knowledge in Computer Network and Distributed System

Course Objective(s):

The objective of the course is to make the students able to –

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Understand the importance of protocols and standards in computing.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Identify** the appropriate cloud services for a given application
CO2	**Assess** the comparative advantages and disadvantages of Virtualization technology
CO3	**Analyze** authentication, confidentiality and privacy issues in cloud computing
CO4	**Identify** security implications in cloud computing.
CO5	**Understand** the importance of protocols and standards in management for cloud services.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1		3	3	1			1					-	3	3
CO 2	3			2								3	-	-
CO 3	2	2			3			1				2	2	-
CO 4		1	3	3					1			-	1	3
CO 5	1											1		-

Course Content:

Module 1: Definition of Cloud Computing and its Basics [8L]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing [3]

Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. [2]

Services and Applications by Type [3]

IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos.

PaaS – Basic concept, tools and development environment with examples

SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform

Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module 2: Use of Platforms in Cloud Computing [6L]

Concepts of Abstraction and Virtualization [2L]

Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution- Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment

Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) [2L]

Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance

Concepts of Platform as a Service [2L]

Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development. Use of PaaS Application frameworks.

Module 3: Cloud Service Models [6L]

Use of Google Web Services [2L]

Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

Use of Amazon Web Services [2L]

Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Use of Microsoft Cloud Services [2L]

Windows Azure platform: Microsoft’s approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure [10L]

Types of services required in implementation – Consulting, Configuration, Customization and Support

Cloud Management [3L]

An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

Live Migration of Virtual Machines [2L]

Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration.

Concepts of Cloud Security [3L]

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management.

Auditing and Compliance in Cloud Environment [2L]

Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

Module 5: Concepts of Services and Applications [6L]

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6]

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs [2]

Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1]

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services [1]

Text book:

1. Distributed and Cloud Computing – From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C Fox, Jack J Dongarra, Morgan Kaufmann Publishers, 2012.
2. “Cloud Computing Bible”, Barrie Sosinsky, Wiley India Edition.

Reference Books:

1. Cloud Computing – A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter, Tata McGraw-Hill Education, 1st Edition, 2009
2. Developing and Hosting Applications on the Cloud, Alex Amies, Harm Suliman, Qiang Guo Tong, Guo Ning Liu, IBM Press, 1st Edition, 2012
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice), George Reese, O'Reilly Publications, 1st Edition, 2009
4. Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing – Applications and Data Centers in the Cloud with SLAs, Haley Beard, Emereo Pty Limited, 1st Edition, July 2008
5. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Michael Miller, Pearson Education, 1st Edition, 2009
6. The Tower and The Cloud: Higher Education in the Age of Cloud Computing, Richard N. Katz, EDUCAUSE, 1st Edition, 2008

Course Name: Mobile Computing

Course Code: AM604A

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites:

1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s):

The objective of the course is to make the students able to –

1. Understand and illustrate the basic concepts and principles in mobile computing.
2. Understand and demonstrate the various routing algorithms for both infrastructures based and ad hoc networks.
3. Identify and develop mobility and bandwidth management in cellular network.
4. Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies.
5. Predict and explain the technical issues related to recent mobile computing environment.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Illustrate**theconceptsandworkingofmodern communication technologies.
CO2	**Demonstrate**thevariousroutingalgorithmsforbothinfrastructurebasedandad hoc networks.
CO3	**Develop**mobilityandbandwidthmanagementincellularnetwork
CO4	**Design**andbuildanenergyefficientandsecuremobilecomputingenvironment using heterogeneous wireless technologies
CO5	**Predict**thetechnicalissuesrelatedtorecentmobilecomputing environment.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2	1			3	2	3	2	2	2
CO 2	3	3	3	3	2	1			3	2	3	2	2	2
CO 3	3	3	2	3	2	1			3	2	3	2	2	2
CO 4	3	3	2	2	2	1			3	2	3	2	2	2
CO 5	3	3	3	3	2	1			3	2	3	2	2	2

Course Content:

Module 1: Introduction [6L]

Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.

Module 2: Mobile Data Communication [5L]

Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.

Module 3: Mobility Management in Cellular Networks [4L]

Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, Brownian, map-based, group-based.

Module 4: Bandwidth Management in Cellular Mobile networks [3L]

Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth, Genetic algorithms for channel assignment- concept of critical block in a hexagonal cellular network, coalesced CAP, fast near-minimal channel assignment algorithm.

Module 5: Localization of Nodes in a Mobile Network [4L]

Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements, selection of beacon nodes; Location region identification- computational geometric technique.

Module 6: Message Communication in Ad Hoc Networks [6L]

Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP

Module 7: Energy-efficient Communication [3L]

Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.

Module 8: Secure Wireless Communication [4L]

Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm, Lightweight cryptographic algorithms; antijamming techniques.

Text book:

1. Wireless Networks and Mobile Computing, K. Sinha, S. Ghosh, B. P. Sinha, CRC Press: New York, 1st Edition, 2015
2. Mobile Communication, J. Schiller, Pearson, 2nd Edition, 2003
3. Wireless and Mobile Networks Architectures, Yi-Bing Lin, Imrich Chlamtac, John Wiley & Sons, 1st Edition, 2001
4. Mobile and Personal Communication Systems and Services, Raj Pandya, Prentice Hall of India, 1st Edition, 2001
5. Wireless, Adhoc and Sensor Networks, Xiang Yang Li, Cambridge University Press, 1st Edition

Reference Books:

1. Research articles on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping), Various Authors, Leading Journals (IEEE, Elsevier, Springer, etc.), Various Editions, Various Years
2. Guide to Designing and Implementing Wireless LANs, Mark Ciampa, Thomson Learning, Vikas Publishing House, 1st Edition, 2001
3. Third Generation Mobile Telecommunication Systems, P. Stavronlakis, Springer Publishers, 1st Edition

Course Name: Quantum Computing

Course Code: AM604B

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: Discrete Structures

Course Objective(s):

The objective of the course is to make the students able to –

1. Understand the basic idea of quantum computing including background of mathematics and physics.

3. Understand and explain the concept of quantum circuits using single and multiple qubit gates and designing quantum circuits.
4. Compare classical and quantum information theory and explain and apply Bell states, Quantum teleportation, Quantum Cryptography, and no cloning theorem.
5. Understand, explain, and apply different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also relate between quantum and classical complexity classes.
6. Understand noise and error correction including graph states and codes, quantum error correction, fault tolerant.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand**thebasicideaofquantumcomputingincludingbackgroundof mathematicsandphysicsrequiredfordevelopingandsolvingcomplexengineering problem in the domain of quantum computing possibly using modern engineering tools.
CO2	**Understand**andexplaintheconceptofquantumcircuitsusingsingleandmultiplequbit gates and designing of quantum circuits for solving engineering problem including societal and environmental issues.
CO3	Compare between classical and quantum information theory and explain and **apply**Bellstates,Quantumteleportation,QuantumCryptographyandnocloningtheorem in solving engineering problem possibly in a team maintain proper ethics of professional collaboration.
CO4	**Understand**, explain and apply different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm,Shorfactorization,Groversearchandalsorelatebetweenquantumand Classicalcomplexity classesforsolvingengineering problem.
CO5	**Understand** noise and error correction including graph states and codes, quantum error correction, fault tolerant computation and apply it in designing and solving complex engineering problems leading to their lifelong learning.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2	1			3	2	3	2	2	2
CO 2	3	3	3	3	2	1			3	2	3	2	2	2

CO 3	3	3	2	3	2	1			3	2	3	2	2	2
CO 4	3	3	2	2	2	1			3	2	3	2	2	2
CO 5	3	3	3	3	2	1			3	2	3	2	2	2

Course Content:

Module 1: Introduction to Neural Network: [8L]

Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network. Back Propagation Learning, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Module 2: Learning Models: [6L]

Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning series.

Module 3: Introduction to Deep Learning: [4L]

Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss.

Module 4: Deep Learning Models: [8L]

Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc. LSTM Networks.

Module 5: Optimization Problem [10L]

Optimization Techniques, Gradient Descent, Batch Optimization, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

Text book:

1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge University Press.
2. Principles of Quantum Computation and Information, Benenti G., Casati G. and Strini G., Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
3. An Introduction to Quantum Computing Algorithms, Pittenger A. O.

Reference Books:

1. An Introduction to Quantum Computing, P Kaye, R Laflamme and M Mosca.
2. "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation), Eleanor G. Rieffel, Wolfgang H. Polak
3. Quantum Computing for Computer Scientists, Yanofsky's and Mannucci.
4. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd.
5. Scott Aaronson, "Quantum Computing since Democritus", Cambridge.
6. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge

Course Name: Parallel Computing

Course Code: AM604C

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: Computer Organization and Architecture

Course Objective(s):

The objective of the course is to make the students able to –

1. Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law to design real life engineering problems.
2. Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention to design and implement mathematical and engineering problems.
3. Identify the concept of Instruction-Level Parallelism to solve engineering problems.
4. Illustrate and Compare concepts of Multiprocessor architecture and parallel architecture.
5. Understand the concept of message-passing architecture and interconnection network and design an optimized model

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Illustrate** the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and **apply** this knowledge in **designing** solutions for real life engineering problems.
CO2	**Summarize** the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention and **use** this knowledge for **designing** and **implementing** mathematical and engineering problem leading to lifelong learning.
CO3	**Identify** the concept of Instruction-Level Parallelism to **solve** engineering problem.
CO4	**Illustrate and Compare** concept of Multiprocessor architecture and parallel architecture and **apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
CO5	**Understand** the concept of message passing architecture and interconnection network and **design** an optimized model for **building** a new solution as a professional engineering practice as a team.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3								3	3	3
CO 2	3	3	3	3							3	3	2	3
CO 3	3	3	3	3								3	3	1
CO 4	3	3	3	3				3				3	2	3
CO 5	3	3	3	3				3	2			3	2	3

Course Content:

Module 1: Introduction [3L]

Review of basic computer architecture [1], Measuring, reporting and summarizing performance [1], quantitative principles of Computer design [1]

Parallel processing [4L]

Parallel processing - concept, architecture [1], Flynn's classification-SISD, SIMD, MISD, MIMD [1], SIMD architecture, MIMD architecture, loosely coupled and tightly coupled computers [1], Amdahl' law [1].

Module 2: Pipelining[8L]

Introduction of pipelining, classification of pipeline [1], Instruction pipeline [1], Arithmetic pipeline [1], hazard detection and resolution in pipeline [3], dynamic pipeline [1], reservation table and case study [2].

Module 3: Instruction-Level Parallelism[6L]

Instruction-Level Parallelism: Basic Concepts [2L], Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array Processor [1], Vector Processors [1L]

Module 4: Multiprocessor architecture[8L]

Shared memory architecture - classification, bus based symmetric multiprocessors [1], cache coherence methods, snooping protocols, directory-based protocols [1], Centralized and Shared- memory architecture: synchronization[1L]

Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW, CREW, CRCW) [3L], Program flow mechanisms – Control flow, data-driven and demand driven [2]

Message passing architecture [4]

Basic concept, Routing in message passing network [1], switching mechanisms in message passing [1], Examples of message passing architecture [1], Message passing vs Shared memory architectures [1]

Module 5: Interconnection Network [3]

Interconnection Network- taxonomy, bus based dynamic interconnection networks [1], switch-based interconnection networks [1], static interconnection networks [1], performance analysis [1L]

Text book:

3. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. A Survey of Interconnection Networks, Tse-yun Feng, IEEE, 1st Edition, 1981

2. The Design and Analysis of Parallel Algorithms, Selim G. Akl, Prentice-Hall, 1st Edition, 1989

Course Name: Data Mining and Data Warehousing

Course Code: AM604D

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites: Machine Learning, Linear Algebra and Data Structures.

Course Objective(s):

The objective of the course is to make the students able to –

1. Understanding principles and architectures of both fields
2. Performing data preprocessing and applying data mining algorithms like classification and clustering.
3. Familiarizing with data warehouse design and implementation
4. Learning to use data mining tools, and evaluating patterns in large datasets for business intelligence and real-world applications

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Study of different sequential pattern algorithms
CO2	Study the technique to extract patterns from time series data and it application in real world.
CO3	Can extend the Graph mining algorithms to Web mining.
CO4	Help in identifying the computing framework for Big Data

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	2		2	2						2	3	2	
CO 2	3	3	2	3	2	1			1		3	2	3	2
CO 3	3	2	2	2	3	1			1		2	2	3	2
CO 4	3	3	2	2	3	1			1	2	3	1	2	3

Course Content:

Module 1: [6L]

Introduction to Data Warehousing; Data Mining:Mining frequent patterns,association andcorrelations; Sequential Pattern Miningconcepts, primitives,scalable methods;

Module 2: [6L]

Classification and prediction; Cluster Analysis – Typesof Data in Cluster Analysis,Partitioningmethods, Hierarchical Methods;Transactional Patterns and othertemporal based frequent patterns,

Module 3: [6L]

Mining Time series Data, Periodicity Analysis for timerelated sequence data, Trend analysis, Similarity searchin Time-series analysis

Module 4: [8L]

Mining Data Streams, Methodologies for stream dataprocessing and stream datasystems, Frequent pattern mining in stream data,Sequential Pattern Mining inData Streams, Classification of dynamic data streams,Class Imbalance Problem;Graph Mining; Social NetworkAnalysis;modulation for communication,filtering, feedback control systems.

Module 5: [7L]

Web Mining, Mining the web page layout structure,mining web link structure,mining multimedia data on the web, Automaticclassification of web documentsand web usage mining; Distributed Data Mining.

Module 6: [3L]

Recent trends in Distributed Warehousing and DataMining, Class ImbalanceProblem; Graph Mining; Social Network Analysis

Text book:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India
4. Data Mining & Warehousing by Ikvinderpal Singh, Khanna Publishing House

Reference Books:

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, Second Edition,

Elsevier Publication, 2011.

2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach,

Addison Wesley,2006.

3. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

Paper name-Cyber Law and Ethics

Paper Code: HU(AM)601

Contact Hours (per week): 2

Total Contact Hours: 36

Credit: 02

Course Objective(s):

1. To understand, explore and acquire a critical understanding of Cyber Law.

2. To learn the basics of a Cyber security

Course Outcomes: Students will be able to:

CO-1: To understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.

CO-2: To acquire in depth knowledge of information technology act, security policies, and legal framework of right to privacy, data security and data protection

CO3: To develop the understanding of relationship between commerce and cyberspace

CO4: To be familiar with network security threats and countermeasures

CO5: To develop competencies for dealing with frauds and deceptions

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**1**
CO2	2	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**
CO3	2	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**2**
CO4	1	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO5	1	**1**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

Course Content:

Module-1

Introduction to Cyber law:

Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement.(8L)

Module-2

Cybercrime Mobile & Wireless devices

Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop(8L)

Module-3

Information Technology Act:

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication. (10L)

Module-4

Tools and Methods used in Cyber-crime:

Proxy servers, Password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: Buffer over flowAttacks, Scripts Kiddies and Packaged Defense (4L)

Module-5

Cyber Ethics:

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics. (6L)

Text Books:

1) Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003)

2) Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi

3) Information Technology Act, 2000, S. R. Bhansali,, University Book House Pvt. Ltd., Jaipur (2003).

Course Name: Neural Network and Deep Learning Lab

Course Code: AM691

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites:

1. Basics of probability theory, linear algebra and calculus at university level.
2. Programming skills (Python will be used throughout the course).

Course Objective(s):

The objective of the course is to make the students able to –

1. Understand generic machine learning terminology
2. Understand motivation and functioning of the most common types of deep neural networks
3. Understand the choices and limitations of a model for a given setting
4. Apply deep learning techniques to practical problems
5. Critically evaluate model performance and interpret results
6. Write reports in which results are assessed and summarized in relation to aims, methods and available data.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand to design and implement various types of neural networks, including feedforward neural networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs), for solving real-world problems.
CO2	**Analyze** the optimizing neural network architectures by fine-tuninghyperparameters and selecting appropriate activation functions.
CO3	**Analyze** and apply deep learning techniques to solve complex tasks such as image classification, natural language processing, and time-series analysis.
CO4	**Implement** the neural network models, interpret their results, and make informed decisions about model improvements and adjustments to data-driven decision- making processes.
CO5	**Understand** selecting appropriate activation functions and employing regularization techniques to improve model performance and prevent overfitting.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3								3	3	3
CO 2	3	3	2	2								3	2	3
CO 3	3	3	3	3			3				3	3	3	2
CO 4	3	3	3	3				3				3	3	3
CO 5	3	2	3	2	3			3	2	3	3	3	2	2

Course Content:

Module 1: Intro to Machine Learning and Neural Networks: [4P]

Supervised learning, linear models for regression, basic neural network structure, simple examples and motivation for deep networks.

Module 2: Lab 1: Introduction of TensorFlow: [4P]

Intro to TensorFlow, simple ML examples.

Module 3: Lab 2: Neural Networks: [8P]

Forward propagation, cost functions, error backpropagation, training by gradient descent, bias/variance and under/overfitting, regularization.

Exercises on NNs, solving a problem with NNs on TensorFlow.

Module 4: Lab 3- Convolutional Neural Networks: [8P]

Convolutional networks. Exercises on CNNs, solving a problem with CNNs on TensorFlow.

Module 5: Lab 3- Recurrent Neural Networks.: [8P]

Recurrent networks. Exercises on RNNs, solving a problem with RNNs on TensorFlow.

Text book:

1. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 1st Edition, 2006, Chapters 1, 3, 5
2. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st Edition, 2016, Chapters 5, 6, 7, 9, 10

Reference Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, 3rd Edition, 2022
2. Neural Networks and Deep Learning: A Textbook, Michael A. Nielsen, Determination Press, 1st Edition, 2015

Course Name: Digital Image Processing Lab

Course Code: AM692

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites:

1. Knowledge of C programming and MATLAB: Design and Analysis of Algorithms,
2. UG Level Mathematics,

3. Python/MATLAB Programming.

Course Objective(s):

The objective of the course is to make the students able to –

1. Understand the practical aspects of digital image processing and identify problems where students can implement the concept appropriately.
2. Understand the practical aspects of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
3. Implement the fundamental image restoration strategies and apply them appropriately to eliminate noise in the image.
4. Implement various Image Compression Techniques and Analyze their performances.
5. Understand the ideas of Morphological Image Processing and Image Segmentation and implement them to solve related problems and analyze the effectiveness as well as limitations of the solutions underscoring its utilitarian importance for further explorations leading towards lifelong learning.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	**Understand**thepracticalaspectsofdigitalimageprocessingandidentifyproblems where students can implement the concept appropriately.
CO2	**Understand** the practical aspects of image enhancement strategies and identify the scopeofenhancementwherestudentscanapplytheappropriatestrategyandanalyze the performance.
CO3	**Implement**thefundamentalimagerestorationstrategiesandapplythem appropriately to eliminate noise in the image.
CO4	**Implement**variousImageCompressionTechniquesandAnalyzetheir performances.
CO5	**Understand**theideasofMorphologicalImageProcessingand ImageSegmentation and implement them to solve related problems with adequate documentation in collaborative environment demonstrating the ability to carry out projects and investigate their effectiveness by analyzing the performances using proper techniques and tools and assess the limitations of the solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

CO-PO Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3							3	3	3	3
CO 2	3	3	3	3	3							3	3	3
CO 3	3	3	3	3			3					3	3	3
CO 4	3	3	3	3			3	3				3	3	3
CO 5							3		3			3	2	3

Course Content:

Module 1: [3L]

Introduction to Digital Image Processing Basics & Python/MATLAB Programming Basics Introduction to Digital Image Processing Basics and Python/MATLAB Programming Basics.

Module 2: [3L]

Image Enhancement in Spatial Domain Implementation of various image enhancement strategies in Spatial Domain.

Module 3: [3L]

Image Enhancement in Frequency Domain Implementation of various image enhancement strategies in Frequency Domain.

Module 4: [3L]

Image Restoration Implementation of various Image Restoration strategies

Module 5: [3L]

Morphological Image Processing Implementation of various Morphological Image Processing strategies

Module 6: [3L]

Image Compression Implementation of various Image Compression strategies.

Module 7: [3L]

Image Segmentation: Detection of Points, lines and Edges (Sobel and Canny); Edge Linking Implementation of various techniques for Detection of Points,

lines and Edges (Sobel and Canny); Edge Linking

Module 8: [3L]

Image Segmentation: Image Thresholding (Otsu's method), Region based segmentation, colour feature based segmentation in color images Implementation of various techniques for Image Thresholding (Otsu's method), Region based segmentation, color-feature based segmentation in color images.

Module 9: [3L]

Discussion on Project Problems and Allocation (Problem Description Report Submission).

Module 10: [3L]

Designing Solution Model and Proposal Report Submission

Module 11: [3L]

Project Implementation, Verification and Documentation

Module 12: [3L]

Project Demonstration and Project Report Review

Text book:

1. Digital Image Processing using MATLAB, Rafael C. Gonzales, Richard E. Woods, Steven L. Eddins, Pearson Education.
2. OpenCV with Python By Example, Prateek Joshi, Oreilly.

Reference Books:

1. Practical Python and OpenCV: An Introductory, Example Driven Guide to Image Processing and Computer Vision, Adrian Rosebrock, PyImage Search.
2. Image Processing, analysis and Machine Vision, Milan S., Thomson Press India Ltd, 4th Edition.

4TH YEAR 7TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
A. THEORY									
1	ENGG	MAJOR	AM701	**WEB TECHNOLOGY**	3	0	0	3	3
2	ENGG	MAJOR	AM702A	**EVOLUTIONARY COMPUTING**	3	0	0	3	3
			AM702B	**COMPUTER VISION**					
			AM702C	**BIG DATA ANALYTICS**					
			AM702D	**INFORMATION THEORY AND CODING**					
3	ENGG	MAJOR	AM703A	**BLOCKCHAIN**	3	0	0	3	3
			AM703B	**BIOINFORMATICS**					
			AM703C	**ROBOTICS**					
			AM703D	**CYBER SECURITY**					
4	HUM	MINOR	HU(AM)701	**HUMAN RESOURCE DEVELOPMENT AND ORGANISATIONAL BEHAVIOUR**	2	0	0	2	2
B. PRACTICAL									
1	ENGG	MAJOR	AM791	**WEB TECHNOLOGY LAB**	0	0	3	3	1.5
C. SESSIONAL									
1	ENGG	PRJ	AM781	**PROJECT- III**	0	0	8	8	8
Total of Theory, Practical								**22**	**20.5**

Course Name: Web Technology

Course Code: AM701

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Basic programming logic (variables, loops, conditionals), Browsers and servers.

Course Objective(s):

The objective of the course is to make the students able to –

1. To impart the design, development, and implementation of Static and Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages and .net framework.
3. To give an overview of Server Side Programming in Web.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	To understand the notions of World Wide Web (www), Internet, HTTP Protocol, Client-Server, etc.
CO2	To develop interactive web pages using HTML, DHTML, CSS and information interchange formats like XML
CO3	To design web applications using scripting languages like JavaScript, CGI
CO4	To produce the server-side programming concepts using servlet, JSP.
CO5	To acquire the knowledge on security related concept and web crawler

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	2	2	3	2	3	2	3	3	3
CO2	-	2	3	2	-	2	2	-	2	3	-	2	3	2

CO3	2	3	-	-	2	3	-	2	3	-	3	-	-	3
CO4	2	2	3	2	2	2	3	2	2	3	2	2	3	2
CO5	1		3	2								-	-	3

Course Content:

Module 1: Introduction (6L): Overview, Network of Networks, Intranet, Extranet, and Internet**.** World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP; Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6; IP Subnetting and addressing: Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.Internet; Routing Protocol :Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail :POP3, SMTP, Clients - Servers Communication.

Module 2: HTML, DHTML &CSS (9L): Introduction, Elements, Attributes, Heading, Paragraph. Formatting; Link, Table, List, Block, Layout, Html Forms, and input ; Iframe, Colors, Image Maps andattributes of image area ; Introduction to CSS, basic syntax and structure of CSS, different typesinternal, external and inline CSS ; Basic Introduction of DHTML, Difference between HTMLand DHTML, Documentary Object Model (DOM). Extended Markup Language (XML) : Introduction, Difference between HTML & XML,XML-Tree; Syntax, Elements, Attributes, Validation and parsing, DTD.

Module 3: Java Scripts(3L): Basic Introduction, Statements, comments, variable, operators, data types; condition, switch, loop, break ; Java script functions, objects, and events. **CGI Scripts(1L):** Introduction, Environment Variable, GET and POST Methods. **Java Servlet(3L):** Servlet environment and role, Servlet life cycle ; Servlet methods-Request,Response, Get and post ; Cookies and Session . **Java Server Page (JSP)(8L):** JSP Architecture; JSP Servers, JSP Life Cycle ; Understanding the layout of JSP, JSP Scriptlet Tag; JSP implicit object (request and response); Variable declaration, methodsin JSP; JSP directive (Taglib and Include), JavaBean- inserting JavaBean in JSP; JSPAction tags (Forward & Include); Creating ODBC data source name, Introduction to JDBC,prepared statement and callable statement.

Module-4: Network Security and Web Technologies(6L) Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks; Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH); Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy; Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Text book:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHILearning, Delhi, 2013. (Topics covered: html, CSS, image map, xml)

2. Learning PHP, MySQL & JavaScript, Robin Nixon, O'Reilly Publication. (Topics covered:Java Script)

Reference Books:

1. Head First Servlet's & JSP, Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication. (Topics covered: Servlet, JSP)
2. Cryptography and Network Security by William Stallings Publisher: Pearson Education India(Topics covered: Threats, Security techniques, Firewall)
3. Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
4. Core Web Programming"- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001

Course Name: EVOLUTIONARY COMPUTING

Course Code: AM702A

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: The students to whom this course will be offered must have the concept of Algorithms and Probability and Statistics. This course is aimed at students who are proficient in a procedural programming language, have a solid understanding of data structures and algorithms, and have a basic understanding of statistics.

Course Objective(s):

The objective of the course is to make the students able to –

1. Gain understanding of various evolutionary computation techniques
2. Identify algorithms suitable for solving certain evolutionary-computation problems
3. Apply evolutionary computation techniques to optimization, learning, and design
4. Implement at least one algorithm from each of the following groups: generic algorithms, representations, selections, and search operators
5. Compare and contrast algorithms in each group mentioned above

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Gain understanding of various evolutionary computation techniques
CO2	Identify algorithms suitable for solving certain evolutionary-computation problems
CO3	Apply evolutionary computation techniques to optimization, learning, and design
CO4	Implement at least one algorithm from each of the following groups: generic algorithms, representations, selections, and search operators
CO5	Compare and contrast algorithms in each group mentioned above

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	3	3	2	3	-	3	3	3	3	3	3
CO2	-	2	-	-	-	3	-	2	-	-	-	2	3	2
CO3	3	-	2	2	3	-	3	-	2	2	2	-	-	3
CO4	2	3	1	-	2	2	2	3	2	2	2	2	3	2
CO5	3	2	_	3	-	3	-	2	3	-	-	-	-	3

Course Content:

Module 1: Introduction to Evolutionary Computing (5L) Fundamentals of Evolutionary Computation**;** Natural Evolution: Darwinian principles, Genetic inheritance**;** Search Spaces, Fitness Landscapes**;** Evolutionary Algorithm Components: Representation, Selection, Variation**;** Types of Evolutionary Algorithms (GA, GP, ES, DE)**;** Overview of Swarm Intelligence Module 2: Module Name (Allotted Number of Lectures).

Module 2: Genetic Algorithms (GA) (7L) Chromosome Representation (Binary, Permutation, Real-valued)**;** Fitness Evaluation**;** Parent Selection: Roulette Wheel, Tournament, Rank-based**;** Genetic Operators: Crossover (single-point, two-point, uniform), Mutation (bit-flip, inversion)**;** Elitism and Replacement**;** Schema Theorem and Convergence.

Module 3: Evolutionary Strategies (ES) and Genetic Programming (GP) (8L) Evolutionary Strategies: (1+λ), (μ+λ), (μ,λ) strategies**;** Self-adaptation of mutation rates**;** Genetic Programming: Tree structures, Function and Terminal Sets**;** Crossover and Mutation in GP**;** Bloat and Bloat Control in GP**;** Applications of ES and GP

Module 4: Differential Evolution (DE) and Swarm Intelligence (7L) Differential Evolution: Mutation, Crossover, Selection strategies**;** Control Parameters in DE**;** Particle Swarm Optimization (PSO): Velocity and Position Updates**;** Constriction Factor and Inertia Weight**;** Comparison between DE, GA, and PSO**;** Real-world Applications.

Module 5: Implementation, Applications, and Trends (9L) EC Toolkits and Libraries: DEAP (Python), PyGAD, MATLAB Toolboxes**;** Benchmark Functions and Performance Metrics**;** Parameter Tuning and Control**;** Real-world Use Cases: TSP, Scheduling, Feature Selection, Neural Network Training**;** Multi-objective Optimization (NSGA-II basics)**;** Research Trends and Future Scope of Evolutionary Computation.

Text Books:

1. A.E. Eiben and J.E. Smith, Introduction to Evolutionary Computing, Second Edition, Springer, 2015.
2. K. Deb, Multi-objective Optimization using Evolutionary Algorithms, Wiley, 2001.

Reference Books:

1. M. Clerc, Particle Swarm Optimization, ISTE, 2006.
2. Goldberg, D.E. – Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley
3. Kennedy, J. and Eberhart, R. – Swarm Intelligence
4. Koza, J.R. – Genetic Programming: On the Programming of Computers by Means of Natural Selection

Course Name: Computer Vision

Course Code: AM702B

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: No prior experience with computer vision is assumed, although previous knowledge of visual computing or signal processing will be helpful. The following skills are necessary for this class:

- Data structures

- Programming: Projects are to be completed and graded in Python. All project starter code will be in Python.
- Mathematics: Linear algebra, vector calculus, and probability.

Course Objective(s):

The objective of the course is to make the students able to –

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	To understand the Image formation process
CO2	To understand the 3D vision techniques
CO3	To extract the features form an images and accordingly analyze the Image
CO4	To develop applications using the Computer Vision Techniques
CO5	To understand the basics of video processing, motion computation and 3D vision and geometry

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO	PSO3
CO1	3	2	2	-	3	-	2	2	3	2	2	3	3	3
CO2	3	2	-	3	-	3	3	3	2	2	3	2	3	2
CO3	2	3	-	2	2	-	3	3	3	-	-	-	-	3
CO4	3	2	3	2	3	2	2	2	3	2	3	2	3	2
CO5	3	2	-	2	-	3	2	2	2	2	2	-	-	3

Module 1: Introduction (7L) Introduction to Computer Vision: Low-level, Mid-level, High-level, Impact of Computer Vision, Components and its applications; Overview: Fundamentals

of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc. Fourier Transform, Convolution and Filtering, Light and Color and Image Filtering, Image Enhancement, Restoration, Histogram Processing.

Module 2: Depth estimation and Multi-camera views (5L) Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Image sensing, pixel arrays, CCD cameras. Image coding, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.Apparel.

Module 3: Feature Extraction, Image Segmentation and Pattern Analysis (18L) Edge detection - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, Image preprocessing, Image representations (continuous and discrete) , Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters andDWT.; Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.; Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods

Module 4: Motion Analysis and Shape representation (6L) Background Subtraction and Modeling, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion ;Inferring 3D shape from shading; surface geometry.Boundary descriptors; codons; super-quadrics;

Text Books:

1. Computer vision: algorithms and applications. Springer Science & Business Media, Szeliski, R., 2010.
2. A modern approach. Computer vision: a modern approach, 17, pp.21-48, Forsyth, D.A. and Ponce, J., 2003.

Reference Books:

1. Multiple view geometry in computer vision.Cambridge university press, Hartley, R. and
2. Zisserman, A., 2003.
3. Introduction to statistical pattern recognition. Elsevier, Fukunaga, K., 2013.
4. Digital image processing addison-wesley. Reading, Ma,2, Gonzalez, R.C. and Woods, R.E., 1992.
5. Digital image processing using MATLAB.PearsonEducationIndia, Gonzalez, R.C., Woods, R.E. and Eddins, S.L., 2004.
6. Shape, contour and grouping in computer vision.Springer, Forsyth, D.A., Mundy, J.L., diGesu, V. and Cipolla, R. eds., 2003.
7. Calibration and orientation of cameras in computer vision (Vol. 34). Springer Science &BusinessMedia, Gruen, A. and Huang, T.S. eds., 2013.

Course Name: Big Data Analytics

Course Code: AM702C

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Programming skills of Python.

Course Objective(s):

The objective of the course is to make the students able to –

1. Comprehend the fundamental concepts of the Big DataAnalytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework).
2. Formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions
3. Apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured datadistributed across multiple locations.
4. Excogitate and Implement ideas to address the challenging issues of Big Data Analytics.
5. Analyze the effectiveness of various Big Data Analytics Frameworks.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand and explain the fundamental concepts of the Big Data Analytics which are primarily explored for making automated decisions using machine learning strategies on analyzing large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework) underscoring the utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	Identify and formulate an engineering problem of analyzing large scale data distributed across multiple locations

	to make automated meaningful decisions within the scope of Big Data Analytics Frameworks.
CO3	Explore relevant literature and apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured data using Map Reduce, Hadoop and advanced SQL Frameworks.
CO4	Excogitate ideas for proposing solutions to the challenging problems of Big Data Analytics.
CO5	Implement ideas of Big Data Analytics through developing feasible algorithms or frameworks and investigate their effectiveness in solving the relevant problems by analyzing the performances using proper techniques.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	2	2	2	2	-	2	3	3	3
CO2	2	3	-	-	-	3	3	3	3	3	3	2	3	2
CO3	2	2	3	2	3	2	2	2	3	2	2	-	-	3
CO4	2	2	2	3	2	2	2	2	-	2	3	2	3	2
CO5	2	2	3	3	2	2	2	2	-	2	2	-	-	3

Course Content:

Module 1: Introduction to Basic Analytics (10L) Introduction: Big data overview, Analyst's perspective on data repositories, Current analytical architecture, Drivers of big data, Examples of big data analytics; Life Cycle of Data Analytics:Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational; Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.

Module 2: Advanced Analytic Methods I (8L) Clustering: Overview, K-means, determining the number of clusters, Diagnostics; Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application of association rules, Validation and testing, Diagnostics; Regression: Linear regression - model description, Logistic regression – model description, Other regression models; Classification: Decision trees – overview, General algorithm, Decision tree algorithms, evaluating a decision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Diagnostics of classifiers.

Module 3: Advanced Analytic Methods II (8L) Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, Moving

average model, ARMA and ARIMA model, Building and evaluating an ARIMA model;Text Analysis: Steps in text analysis, Collecting raw text, Representing text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing documents by types, Determining sentiments; Map Reduce and Hadoop:Analytics for unstructured data – map reduce, Apache Hadoop, Hadoop Ecosystem – Pig, Hive, Hbase, Mahout.

Module – 4: Advanced Analytic Methods III (10L) Technology and Tools: SQL essentials - Join, Set, Grouping extensions, Advanced SQL – Window functions, User-defined functions, Ordered aggregates, MADlib, NoSQL;Integration of Techniques: Communicating and operationalizing an analytic project. Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details, Recommendations, Providing technical specifications and code; Data visualization basics - Key points, evolution of a graph, common representation methods, how to clean up a graphic.

Text Books:

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons, 2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

Reference Books:

1. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-time Data Systems. Manning Publications, 2015.
2. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

Course Name: Information Theory and Coding

Course Code: AM702D

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Probability & Statistics

Course Objectives:

The objective of the course is to make the students able to

1. Understand the basic concept of information and apply this knowledge in designing solution.
2. Understand the basic concept of coding theory and use this knowledge for designing and implementing problem.
3. Understand the concept of channel models to determine the mutual information in the channels.
4. Outline the concept of error detection techniques and design a model for building a new solution.
5. Understand how convolutional theory works and develop a new approach.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand the basicconcept of information andapply this knowledge in designing solution for real life engineering problem.
CO2	Understandthe basic concept of coding theory and usethis knowledge for designingan implementing mathematical and engineeringproblem leading to lifelong learning.
CO3	Understand the concept of channel models to determine the mutual information in th channels.
CO4	Outline the concept of error detection techniques anddesign a model for building a new solution as a professional engineering practice as a team.
CO5	Understand how convolutional theory works anddevelop an approach to solve it by means o existing and newmethods as a team work.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	3	2	3

Course Content:

Module 1: Information Theory (4L) Introduction, Measure of Information, Average Information Content (Entropy) of a Zero Memory Source, Extension of Zero Memory Source, Entropy of a Source with Memory.

Module 2: Source Coding (9L) Introduction, Types of Codes, Prefix Codes, Source Coding Theorem, Shannon's Encoding Theorem, Huffman Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run Length Encoding, An Overview on Speech and Image Compression.

Module 3: Information Channels(4L) Introduction, Channel Models, System Entropies, Mutual Information (Trans information), Channel Capacity, Capacity of Channels, Continuous Channels.

Module 4: Error Control Coding (8L) Introduction, need for Error Control Coding, Types of Codes, Coding Gain, Linear Block Codes, The Hamming Codes, Probability of an Undetected Error Pattern for an LBC over a BSC, Equivalent Codes, Cyclic Codes, Golay Codes, Shortened CyclicCodes.

Module 5:Burst Error Correcting Codes & Convolution Codes (6L) Introduction, Burst Errors, Interleaved Codes, Product Codes, Fire Codes, BCH Codes, Non-Binary BCH Codes and Reed-Solomon Codes; Introduction, Convolution Encoder, Representation of Convolution Code, Transfer Function of a Convolution Code, Distance Properties of Convolution Codes, Decoding of Convolution Codes, Stack Algorithm, Known Good Convolution Codes.

Text Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.

Reference Books:

1.Introduction to Information Theory - M Mansurpur; McGraw Hill.
2. Information Theory - R B Ash; Prentice Hall.
3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Course Name: Blockchain

Course Code: AM703A

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Computer Networks, Data Structures and Algorithms, Database Management Systems (DBMS)

Course Objective(s):

The objective of the course is to make the students able to –

To provide students with a comprehensive understanding of the fundamentals of blockchain technology, including its architecture, cryptographic foundations, consensus mechanisms, smart contracts, and applications in various domains. The course also aims to develop practical skills in developing blockchain-based solutions.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Understand the fundamental concepts, architecture, and characteristics of blockchain technology.
CO2	Apply cryptographic techniques such as hashing and digital signatures in blockchain environments.
CO3	Analyze various consensus mechanisms and evaluate their suitability for different blockchai platforms.
CO4	Design and implement smart contracts using platforms like Ethereum.
CO5	Evaluate real-world applications of blockchain across industries and assess associated challenges and opportunities.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3

CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	3	2	3

Course Outcome:

Course Contents:

Module 1:Discover Blockchain Technology(9L) Blockchain, Growth of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain. Decentralization: Methods of decentralization, Routes of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

Module 2: Blockchain(9L) Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications; Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.

Module3: Concept of Double Spending(10L) Hashing, Proof of work. Bitcoin Network and payments, Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin, Bitcoin Clients and APIs.

Module 5:Introduction to Blockchain Platforms(10L): Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc. Advantages and Disadvantages, Ethereum vs Bitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.

Text Books:

1. Mark Gates, “Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money”, Wise Fox Publishing and Mark Gates 2017.

2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.

Reference Books:

Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.

Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", O'Reilly Media, Inc. 2014. 2. Melanie Swa, "Block chain ",O'Reilly Media 2014.

Course Name: Bioinformatics

Course Code: AM703B

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Cell structure and function, Basic Molecular Biology, Introductory programming knowledge.

Course Objective(s):

The objective of the course is to make the students able to –

1. Be familiar with the modeling techniques.
2. Learn microarray analysis.
3. Exposed to Pattern Matching and Visualization.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	To acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2	To develop idea in MOLECULAR BIOLOGY

CO3	To understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CO4	To acquire the knowledge of the DNA SEQUENCE ANALYSIS
CO5	To analyze the performance of different types of Probabilistic models used in Computational Biology

CO-PO Mapping:

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

Course Content:

Module 1:**Introduction To Molecular Biology(7L)**Concepts of Cell, tissue, types of cell, components of cell, organelle.Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept; Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA; Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways; Introduction to Bioinformatics. Recent challenges in Bioinformatics.

Module 2:**Introduction to Genomic data, Data Organization and Sequence Databases(10L)**Sequence Data Banks - Introduction to sequence data banks - protein sequence data bank. Signal peptide data bank, Nucleic acid sequence data bank - GenBank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks;Introduction to MSDN (Microbial Strain Data Network):Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;

Module 3: DNA Sequence Analysis (8L)DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Secondary Structure predictions;prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.Tertiary Structure predictions;

prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Module 4: Introduction Probabilistic models used in Computational Biology(10L) Probabilistic Models; Gene Regulatory Method Application of HMM in Bioinformatics: Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions : Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling& Dynamics, Drug Designing.

Text Book:

1. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.

References Book:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005

Course Name: Robotics

Course Code: AM703C

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites:

1. Microprocessor & Microcontroller
2. Computer Organization & Architecture

Course Objective(s):

The objective of the course is to make the students able to –

1. To study microcontroller operations for robotics.
2. To study how different interfaces are actually implemented in a microcontroller.
3. To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed
4. To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program.
5. To design robots in a real time environment.

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	To describe and explain the microcontrollers used the in robots.
CO2	To design the software and build the prototype of robots.
CO3	To apply localization and mapping aspects of mobile robotics.
CO4	To demonstrate self-learning capability.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	-	3	-	-	-	3	-	3	3	3	3	3
CO2	2	3	-	1	-	-	-	-	3	-	2	3	2	3
CO3	2	3	3	-	3	3	-	3	-	2	-	3	3	1
CO4	2	2	-	-	-	-	-	-	2	-	3	3	2	3

Course contents:

Module 1: Introduction (5L) Brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals; Position and

orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, commonsensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Module 2: Robot Kinematics and Inverse Kinematics(8L) Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator; Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.

Module 3: Dynamics and Statics of Serial and Parallel Manipulators(8L) Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics; Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators.

Module 4: Advanced Control of Robotic Manipulators and Trajectory Planning(9L) Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.

Module 5: Nonlinear Dynamics, Mobile Robots, and Deployable Mechanisms(6L) Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled

WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR‘s on uneven terrain, Simulations using Matlab and ADAMS; Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE‘s).

Text Books:

1. Myke Predko, ―Programming Robot Controllers‖ – McGrawHill, 1st edition, 2003.

Reference Books:

1. Michael slater, ―Microprocessor – based design: A comprehensive Guide to Effective Hardware Design, Prentice Hall, 1989.
2. Myke Predko, ―Programming and customizing the 8051- micro-controller‖, Tata McGraw-Hill, New Delhi, 2000.

Course Name: Cyber Security

Course Code: AM703D

Contact: 3:0:0

Total Contact Hours: 36L

Credit: 3

Prerequisites: Networking Basics, Basic understanding of scripting or programming languages, Concept of digital identity and data privacy.

Course Objective(s):

The objective of the course is to make the students able to –

1. To learn threats and risks within context of the cyber security
2. To have an overview of the cyber laws & concepts of cyber forensics
3. To study the defensive techniques against these attacks

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	Analyze cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
CO2	Interpret and forensically investigate security incidents
CO3	Apply policies and procedures to manage Privacy issues 4.Design and develop secure software modules
CO4	Design and develop secure software modules using secure coding practices to minimize vulnerabilities.
CO5	Evaluate risk assessment methodologies and implement security controls to protect information systems and infrastructure.

CO-PO Mapping:

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

Course Content:

Module 1: Introduction to Cyber Security (8L) Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Module 2: Cyberspace and the Law & Cyber Forensics (9L) Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

Module 3: Cybercrime: Mobile and Wireless Devices (5L) Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

Module 4: Cyber Security(5L) Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Module 5: Privacy Issues: Basic Data Privacy Concepts (9L) Fundamental Concepts, Data Privacy Attacks, Datalinking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Books:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives,Wiley

2. B.B.Gupta,D.P.Agrawal,HaoxiangWang,ComputerandCyberSecurity:Principle s, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Paper Name: Human Resource Development and Organisational Behaviour
Paper Code: HU(AM)701
Contact Hours (per week):03
Total Contact Hours:34
Credit:03

Course Objective(s):
1. To develop an understanding of the nature, functioning and design of organisation as social collectivises.
2. The basic concepts and theories underlying individual behaviour besides developing better insights into one's own self.
3. To gain insight into the organisational learning processes, how they can be fostered and enhanced.
4. Individual behaviour in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves.

Course Outcome(s): At the end of the course students are able to:
CO1: To understand key functions in management as applied in practice.
CO2: To identify and analyze major practices associated with HRD in modern work and organization
CO3: To evaluate the connections between the HRD process and the contemporary performance management concerns of organisations
CO4: To assess the potential effects of organisational-level factors (such as structure, culture and change) on organisational behaviour.
CO5: To evaluate the potential effects of important developments in the external environment (such as globalisation and advances in technology) on organisational behaviour

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSo03
CO1	3	3	3	3									2	3	3
CO2	3	3	3	2									2	3	2
CO3	3	3	3	3				3					3	3	2
CO4	3	2	3	3					3				2	3	3
CO5	3	3	3	3	3				3				2	3	3

Course Content:

Module-1

Introduction to Human Resource Management:

HRM: Meaning, definition and functions. Job Analysis, Job Design, Human Resource Planning - Recruitment and Selection - Sources of Recruitment - Selection process, Placement and Induction. (8L)

Module-2

Human Resource Development:

Introduction to Human Resource Development: Concepts - Training and Development - methods of training, importance of Performance Appraisal, traditional and modern methods of performance appraisal, Job Evaluation - methods of Job Evaluation, Wage and Salary Administration (10L)

Module-3

Introduction to Organisational Behaviour:

Meaning and scope of organisational behaviour - Challenges and Opportunities – Foundations of Individual behaviour, Motivation - Theories (Maslow, ERG, Douglas McGregor two-factor theory), Group dynamics, Leaderships styles(6L)

Module-4:

Organisational Conflict and Change:

Organizational Conflict - causes and consequences - conflict and negotiation, Organizational change, change management process, resistance to change, flexibility and crisis management – Organisational Development – concept and significance (10L)

TEXTBOOKS

1. K. Aswathappa, Organizational Behaviour, 12thedition, Himalaya, 2016
2. Edwin B. Flippo, Personnel Management, 6thedition, TMH, 2013
3. C.B. Mamoria& VSP Rao, Personnel Management, 20thedition, Himalaya, 2015
4. Stephen P. Robins, Organisational Behaviour, 11th edition, PHI Learning / Pearson Education, 2008

References:

1) Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005
2) Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.
3) Luthans, Fred: OrganisationalBehaviour, Tata McGraw-Hill Co. New Delhi, 2004.

Course Name: Web Technology Lab

Course Code: AM791

Contact: 0:0:3

Total Contact Hours: 36

Credit: 1.5

Prerequisites: Fundamentals of Programming

Course Objective(s):

The objective of the course is to make the students able to –

1. To impart the design, development and implementation of Static and Dynamic Web Pages
2. To develop programs for Web using Scripting Languages and .net framework
3. To give an overview of Server Side Programming in Web

Course Outcomes (COs):

After Successful completion of the course, students will be able to

CO1	To develop interactive web pages using HTML, DHTML, CSS and image map
CO2	To procure the knowledge of information interchange formats like XML
CO3	To validate fields of web pages using scripting languages like JavaScript

CO4	To develop web applications using PHP and ASP.net
CO5	To acquire the server side programming concepts using servlet, JSP

CO-PO Mapping

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

List of Experiments:

1. Write a single html program through which you can explain a) anchor tag, b)'img' tag with 'src' attribute, c)paragraph d) heading.

2. Write a single html program through which you can draw a table which consists of 3 row and 4 columns where 1st row contains 4 different column fields of a student's information with red text color and Calibri font style with font 12. Rest cells of whole table contain values with blue text colors and Times new roman font style with font 10.

3. Write a single html program where 1st paragraph can collect its specified style from internal stylesheet describes inside that html program and 2nd paragraph can collect its specified style from another file (external stylesheet).

4. Write a single html program which implements image map concept using 'usemap' and <map>.

5. Write a html program to find out Celsius temperature of a given Fahrenheit temperature using JavaScript.

6. Write a html program to find out m to the power n (m, n valid integer no) using a function using javascript.

7. Write a xml parsing technique through which parse a text string into an XML DOM object, and extracts the info from it with JavaScript.

8. Write a simple php program through which you can find out maximum and minimum among three no's specified by the user.

9. Write a simple php program through which you can implement the concept of GET & POST method w.r.t PHP Form handling.

10. Write a simple program in ASP.net through which you can create a login page of your own website.

11. Write a simple JSP program through which you can print even and odd no separately within a given range.

12. Create a Online Registration form for individual user of an website using Servlet.

Textbooks:

1. "Web Technology: A Developer's Perspective", N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Topics covered: html, CSS, imagemap, xml)
2. "Learning PHP, MySQL & JavaScript", Robin Nixon, O'Reilly Publication.(Topics covered: PHP, Java Script)
3. "Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication.(Topics covered: Servlet, JSP)
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:" Jonas Frajerberg, O'Reilly Publication.(Topics covered: MVC, ASP.Net, C#)

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. "Core Web Programming"- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001.
3. "Web Technologies", Black Book, Dreamtech Press

4TH YEAR 8TH SEM									
SL. NO.	BROAD CATEGORY	CATEGORY	COURSE CODE	COURSE TITLE	HOURS PER WEEK				CREDIT
					L	T	P	TOTAL	
C. SESSIONAL									
1	ENGG	MAJOR	AM881	**Grand Viva**	0	0	0	0	2
2	ENGG	PRJ	AM882	Internship/Entrepreneurship	0	0	0	10	10
Total of Theory, Practical								**10**	**12**
TOTAL FOURTH YEAR CREDIT									**32.5**

TOTAL CREDIT = 161