Asansol Engineering College

(NAAC 'A' Accredited an Autonomous Institute)
(Affiliated to Maulana Abul Kalam Azad University of Technology)

R25 [B.Tech., IT]

Curriculum and Syllabus for B.Tech. under Autonomy (NEP-2020 implemented)

Dept. of Information Technology

(Effective from 2025-26 admission batch)

Asansol Engineering College
Vivekananda Sarani, Kanyapur, Asansol - 713305
Phone: +91 341 2253057, Telfax: +91 341 2553057
Website: www.aecwb.edu.in, Email: principal@aecwb.edu.in

R25 (All B. 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

1st Year 1st Semester (Gr-B)

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	ENGG	Minor	CS102	Introduction to Artificial Intelligence	2	0	0	2	2
3	SCI	Multidisciplinary	CH101	Engineering Chemistry	2	0	0	2	2
4	SCI	Multidisciplinary	M101	Engineering Mathematics- I	3	0	0	3	3
5	HUM	Value Added Courses	HU105	Constitution of India & Professional Ethics	1	0	0	1	1
6	HUM	Ability Enhancement Course	HU103	Design Thinking & Innovation	1	0	0	2	1
B. PRACTICAL									
1	ENGG	Major	CS191	Introduction to Programming and Problem Solving Lab	0	0	3	3	1.5
2	ENGG	Minor	CS192	Artificial Intelligence Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME193	IDEA LAB Workshop	0	0	3	3	1.5
MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
Total of Theory, Practical								23	17.5

1st Year 2nd Semester (Gr-B)									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	IT201	Data structure and Algorithms	3	0	0	3	3
2	ENGN	Major	IT202	Object Oriented Programming with Java	3	0	0	3	3
2	SCI	Multi disciplinary	PH201	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M201	Engineering Mathematics –II	3	0	0	3	3
5	HUM	Value Added Course	HU201	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU202	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT291	Data structure and Algorithm Lab	0	0	3	3	1.5
2	ENGG	Major	IT292	Object Oriented Programming with Java Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	PH291	Engineering Physics Lab	0	0	3	3	1.5
3	ENGG	Skill Enhancement Course	ME294	Engineering Graphics & Computer Aided Design Lab	0	0	3	3	1.5

4	HUM	Ability Enhancement Course	HU291	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
Total of Theory, Practical								**29**	**22.5**
TOTAL FIRST YEAR CREDIT									**40**

2nd Year 3rd Semester

Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	IT302	Formal Language and Automata Theory	3	0	0	3	3
3	ENGG	Major	IT303	Software Engineering	2	0	0	2	3
4	ENGG	Minor	EC(IT)301	Analog and Digital Electronics	3	0	0	2	3
5	SCI	Multidisciplinary	M(IT)301	Discrete Mathematics	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IT391	Computer Organization and Architecture	0	0	2	2	1.5
2	ENGG	Skill Enhancement Course	IT392	Python Programming Lab	0	0	3	3	1.5
3	ENGG	Major	IT393	Software Engineering	0	0	2	2	1.5
4	ENGG	Minor	EC(IT)391	Analog and Digital Electronics	0	0	2	2	1.5
5	HUM	Ability Enhancement Course	HU(IT)391	Soft Skill andAptitude	0	0	1	1	1
Total of Theory, Practical								28	21

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2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT401	Operating System	3	0	0	3	3
2	ENGG	Major	IT402	Advanced Artificial Intelligence	3	0	0	3	3
3	ENGG	Major	IT403	Design Analysis & Algorithm	3	0	0	3	3
4	ENGG	Minor	M(IT)401	Probability & Statistics	2	0	0	2	2
5	ENGG	Minor	EC(IT)401	Microprocessor & Microcontroller	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IT491	Operating System Lab	0	0	3	3	1.5
2	ENGG	Major	IT492	Advanced Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	IT493	Design Analysis & Algorithm Lab	0	0	3	3	1.5
4	ENGG	Major	IT494	R-Programming Lab	0	0	2	2	1.5
5	ENGG	Minor	EC(IT)491	Microprocessor & Microcontroller Lab	0	0	3	3	1.5
6	ENGG	Ability Enhancement Course	HU(IT)491	IT Workshop Lab (SciLab / MATLAB/ C++)	0	0	3	3	1.5
Total of Theory, Practical								27	22

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT501	Database Management System	3	0	0	3	3
2	ENGG	Major	IT502	Computer Networking	3	0	0	3	3
3	ENGG	Major	IT503	Machine Learning	3	0	0	3	3
4	ENGG	Major	IT504	Full Stack Web Development	3	0	0	3	3
5	ENGG	Minor	IT501A	Operation Research & Optimization Technique	3	0	0	3	2
			IT501B	Ecommerce & ERP					
			IT501C	Compiler Design					
			IT501D	Distributed System					
6	HUM	Minor	HU(IT)501	Economics for Engineers	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT591	Database Management System Lab	0	0	3	3	1.5
2	ENGG	Major	IT592	Computer Networking Lab	0	0	3	3	1.5
3	ENGG	Major	IT593	Machine Learning Lab	0	0	3	3	1.5
4	ENGG	Major	IT594	Full Stack Web Development Lab	0	0	3	3	1.5
5	PRJ	Project	IT581	Project-1	0	0	3	3	1
Total of Theory, Practical								34	22

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT601	Cloud Computing	3	0	0	3	3
2	ENGG	Major	IT602	Internet of Things	3	0	0	3	3
3	ENGG	Major	IT603	Cryptography and Network Security	3	0	0	3	3
4	ENGG	Major	IT604	Data Warehousing and Data Mining	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(IT)601	Project Management and Finance	2	0	0	2	2
6	ENGG	Minor	IT605A	Digital Image Processing	3	0	0	3	2
			IT605B	Mobile Communication					
			IT605C	Internet Technology					
			IT605D	Computer Graphics and Multimedia					
B. PRACTICAL									
1	ENGG	Major	IT691	Cloud Computing Lab	0	0	3	3	1
2	ENGG	Major	IT692	Internet of Things Lab	0	0	3	3	1
3	ENGG	Major	IT693	Cryptography and Network Security Lab	0	0	3	3	1
4	ENGG	Internship	IT681	Industrial Training and Project (Duration: 1 months)	0	0	0	0	2
Total of Theory, Practical								30	21

4th Year 7th Semester									
Sl. No.	**Broad Category**	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT701	Deep Learning	3	0	0	3	3
2	ENGG	Major	IT702A	Block Chain Technology	3	0	0	3	3
			IT702B	BigData Analytics					
			IT702C	Digital Forensics					
			IT702D	Soft Computing					
3	ENGG	Minor	IT703A	Quantum Computing	3	0	0	3	3
			IT703B	Pattern Recognition					
			IT703C	Bioinformatics					
			IT703D	Cyber Law and IPR					
B. PRACTICAL									
1	ENGG	Major	IT791	Deep Learning	0	0	2	2	1.5
2	ENGG	Internship	IT781	Internship (Min. 1 Month)	0	0	0	0	1.5
3	ENGG	Skill Enhancement Course	PR792	Rapid Prototyping Lab	0	0	0	4	2
4	PRJ	Project	IT782	Minor Project	0	0	0	6	6
Total of Theory, Practical								24	20

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
B. PRACTICAL									
1	ENGG	Internship	IT881	Internship (Min. 1 Month)	0	0	0	0	2
2	PRJ	Project	IT882	Major Project	0	0	0	12	12
Total of Theory, Practical								14	14

1st Semester

1st Year 1st Semester (Gr-B)									
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	ENGG	Minor	CS102	Introduction to Artificial Intelligence	2	0	0	2	2
3	SCI	Multidisciplinary	CH101	Engineering Chemistry	2	0	0	2	2
4	SCI	Multidisciplinary	M101	Engineering Mathematics- I	3	0	0	3	3
5	HUM	Value Added Courses	HU105	Constitution of India & Professional Ethics	1	0	0	1	1
6	HUM	Ability Enhancement Course	HU103	Design Thinking & Innovation	1	0	0	2	1
B. PRACTICAL									
1	ENGG	Major	CS191	Introduction to Programming and Problem Solving Lab	0	0	3	3	1.5
2	ENGG	Minor	CS192	Artificial Intelligence Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME193	IDEA LAB Workshop	0	0	3	3	1.5
MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
Total of Theory, Practical								23	17.5

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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2						2			
CO2	2	2	3	3	3									
CO3	2	3	2	2	2									
CO4	3	2	2	3	3									
CO5	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 Code	**CS102**
Course Name	**Introduction to Artificial Intelligence**
Practical (per week)	**0**
Tutorial (per week)	**36**
Contact Hours (per week)	**1**
Total Contact Hours	**36**
Credit	**3**

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

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Artificial Intelligence (6 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
2	**Intelligent Agents and Logic-Based Thinking (7 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
3	**Overview of AI Branches and Perception (8 Lectures)** Machine learning • Deep learning • Natural language processing • Computer vision • Robotics • Expert systems • Fuzzy logic • Evolutionary algorithms • Reinforcement learning • Swarm intelligence • Planning and scheduling • Affective computing • Explainable AI • Cognitive computing • Ethical AI • Speech recognition • Gesture recognition • Emotion detection • Facial recognition • Human-AI collaboration
4	**Basics of Machine Learning (8 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
5	**Applications and Ethics of AI (7 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 scope in AI

Textbook:

1. Saptarsi Goswami , Amit Kumar Das , Amlan Chakrabarti - AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI)
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. Reema Thareja, Artificial Intelligence: Beyond Classical AI
2. Patterson , Introduction to Artificial Intelligence and Expert Systems

Course Name: ENGINEERING CHEMISTRY
Course Code: CH 101
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)

Quantum Properties of Atoms (4L)

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 - 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: Constitution of India and Professional Ethics

Course Code: HU105
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	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	HU103 / HU203		
(L-T-P)	(1-0-0)		
Class Hours / Week	01		
Total class hours	15		

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

Sl. No.	Course outcomes	Mapping to POs
1.	Analyze emotional experience and expressions to better understand stakeholders while designing innovative products through group brainstorming sessions.	PO1, PO2, PO4, PO5, PO7, PO8 & PO9
2.	Generate and develop design ideas through different technique	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO10 & PO11
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	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO10 & PO11

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).	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, 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	3
	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: 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 the students will be able to

CO1	Construct algorithms and translate them into working C programs using basic syntax and control flow.
CO2	Develop C programs using arrays, pointers, and string handling techniques to solve computational problems.
CO3	Implement modular programs with functions and recursion to promote reusability and code organization.
CO4	Use dynamic memory allocation and structured data types like struct, union, and enum in problem-solving.
CO5	Demonstrate file handling operations and evaluate results from formatted and unformatted data processing using system-level functions.

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:

3. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchiem, Prentice Hall, 2nd 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 Code	**CS192**
Course Name	**Introduction to Artificial Intelligence Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

MODULE NUMBER	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. Understanding facts, rules, queries, and syntax.
2	**Recursive definitions in Prolog**
3	Fibonacci Series, Calculator, Factorial, summation, list length, etc. Using recursive rules.
4	**Defining facts and simple queries** Writing a knowledge base for family relationships, basic objects.
5	**Rules and inference in Prolog** Creating logical rules and testing inferences.
6	**List operations in Prolog** Checking membership, concatenation, reverse, max/min of list.
7	**Pattern matching and symbolic reasoning** Simple examples involving pattern recognition (e.g., shape or name matching, Family Tree design) **Expert system simulation (Mini project)** Building a mini knowledge-based system (e.g., Animal Classification, Medical diagnosis, etc).

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: ENGINEERING CHEMISTRY LAB
Course Code: CH 191
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

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 Code :	ME193
Course Title :	IDEA Lab Workshop
Number of Credits :	(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 - Tapemeasure, combination square, Vernier calliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping andthreading. 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 testiof 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 scan 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 hardwasoftware and machined or 3D printed enclosure.

Reference Books:

S. No.	Title
1.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), 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 SimonMonk. McGraw Hill. ISBN-13: 978-1259587542
10.	Encyclopedia of Electronic Components (Volume 1, 2 and 3). CharlesPlatt. 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, CBSPublishers and distributors, 5th Edition,2002.

2nd Semester

1st Year 2nd Semester (Gr-B)									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	IT201	Data structure and Algorithms	3	0	0	3	3
2	ENGN	Major	IT202	Object Oriented Programming with Java	3	0	0	3	3
2	SCI	Multi disciplinary	PH201	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M201	Engineering Mathematics –II	3	0	0	3	3
5	HUM	Value Added Course	HU201	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU202	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT291	Data structure and Algorithm Lab	0	0	3	3	1.5
2	ENGG	Major	IT292	Object Oriented Programming with Java Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	PH291	Engineering Physics Lab	0	0	3	3	1.5
3	ENGG	Skill Enhancement Course	ME294	Engineering Graphics & Computer Aided Design Lab	0	0	3	3	1.5

Course Name: **DATA STRUCTURE AND ALGORITHM**
Course Code: **IT201**
Contact: (L:T:P) **3:0:0**
Total Contact Hours: 36
Credits: **3**

Prerequisites: Basic Mathematics, Programming language

Course Objective(s):

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

1. Develop an understanding of how to manage and manipulate large volumes of data effectively, including applications in databases, indexing systems, and real-time processing.
2. Apply formal design principles and use programming languages that emphasize data structures as a foundational element of robust and maintainable software architecture.
3. Analyze various data structures to determine their suitability for different types of problems, recognizing that some are optimized for very specific use-cases.
4. Create and employ data structures that directly contribute to designing algorithms with optimal performance in terms of time and space complexity.
5. Strengthen analytical thinking by modeling real-world problems into abstract data representations, enabling efficient algorithmic solutions.

Course Outcomes (COs):

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

CO1	Understand the concept of large amounts of data efficiently, such as large databases and indexing services.
CO2	Use some formal design methods and programming languages which emphasize on data structures, as the key organizing factor in software design.
CO3	Analyze different kinds of data structures which are suited to different kinds of applications, and some are highly specialized to specific tasks.
CO4	Create efficient data structures which are a key to designing efficient algorithms.

CO-PO Mapping:

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

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

Course Content:

Module I: Concepts of data structures [4L]

a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

Module II: Linear Data Structure (Array, Link List, Stack, Queue, Recursion) [12L]

Array: Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked list: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.
Stack and its implementations (using array, using linked list), applications. Queue, circular queue, Dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications-The Tower of Hanoi, Eight Queens Puzzle

Module III: Non-Linear Data Structure (Tree, Graph) [10L]

Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees, B+ Tress –operations (insertion, deletion with examples only). Huffman tree.
Graphs: Graph definitions and Graph representations/storage implementations–adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity–Depth-first search(DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, Forward-edge), applications. Minimal spanning tree– Prim‘s algorithm.

Module IV: Searching, Sorting, Hashing Algorithm [10L]

Searching: Sequential search, binary search, interpolation search. Internal sorting and external sorting Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap), and radix sort. Tree Sort technique. Hashing: Hashing functions, collision resolution techniques.

Text book:

1. Data Structure using C ,by E. Balagurusamy .Mcgraw Hill)
2. Data Structures ,by Reema Thereja, OXFORD Publications

Reference Books:

1. Data Structures Using Cand C++,by Moshe J.Augenstein, ,Aaron, M. Tenenbaum
2. Data Structures by S. Lipschutz.
3. Data Structures and Algorithms Using C by Amitava Nag and Joyti Prakash Singh, VIKASH Publication

Course Name: Object Oriented Programming using Java
Course Code: IT202
Contact: (L:T:P)
3:0:0 Total Contact
Hours: 36 Credits: 3

Prerequisites: Basic Programming, Computer Fundamentals

Course Objective(s):

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

6. O1 Understand basic of Object Oriented Programming.
7. O2 Understanding the features of Java.
8. O3 Enable students to write Java program and develop projects

Course Outcomes (COs):

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

CO1	Understand the key concepts of Object Oriented Programming
CO2	Apply basic to advanced features of Object Oriented Programming for problem solving
CO3	Analyze various programming approaches with different feature of Object Oriented Programming
CO4	Evaluate the application and use of different feature of Object Oriented Programming
CO5	Design project by the acquired concepts form Object Oriented Programming

CO-PO Mapping:

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

Course Content:

Module 1: Object Oriented Concepts (2L)
Class, object, message passing, inheritance, encapsulation, polymorphism Difference between OOP and other conventional programming – advantages and disadvantages. relationships among objects, aggregation, links, relationships among classes-association, aggregation

Module 2: Understanding Java Programming Language (2L)
History of Java Programming languages, Purpose of invention of Java. Structure of a basic Component of Java Development Kit-API, JRE, Understanding the steps to run a complete Java Program.

Module 3: Components of Java Programming (4L)

Java Tokens-Literals, identifier, keywords, operator, separator, Data types, variables, constant, Type casting- defining type casting, requirement of type casting, implicit and explicit type casting. Control structure. Access specifier, JShell

Module 4: Class and Object Properties (12L)
Defining class and object, Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection, Array-Declaring and defining array, accessing array elements, length properties, 2D array, anonymous array, array of Objects. Understanding method- method returning object, passing objects, method passing and returning arrays, use of method overloading. Static-Static block and non static block, static variable, static method. Nested& inner classes. Lambda expression.

Module 5: Reusability Properties (10L)
Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super () method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages. Annotation, Introduction to the concept of Module

Module 6: String Handling (1L)

Basic string handling concepts- String (discuss charAt() , compareTo(),equals(), equalsIgnoreCase(), indexOf(), length()
, substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() ,trim() , valueOf() methods) &StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods),concept of mutable and immutable string, command line arguments.

Module 7: Exception Handling and Multithreading (5L)
Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes, exception with arguments. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Assertion

Module 8: IO Operations (3L)

Understanding unformatted and formatted IO. Reading and writing files. Serialization and deserialization.

Text book:

1. Java Complete Reference, Herbert Schieldt, TATA McGraw Hills
2. Core Java: An Integrated Approach, R. Nageswara Rao, Dream Tech

Reference Books:

1. Head First Java, Kathy Sierra, O'reilly
2. Beginning Programming with Java For Dummies, Barry Brud, For Dummies
3. Effective Java, Joshua Bloch, Addison-Wesley Professional

Course Name: Engineering Physics
Course Code: /201
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, fiber 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 behavior.
CO5	*Describe* the properties of nanomaterials and display/storage devices and *analyze* their applications in modern technology.

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			
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

3.03 Statistical Mechanics

Concept of energy levels and energy states, phase space, microstates, macro states 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 - 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 –

4. Develop a thorough understanding of ordinary differential equations and their role in modeling real-world systems.
5. Build competency in applying the Laplace transform as a tool for solving initial value problems and linear differential equations in engineering contexts.
6. 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 for$p$, solvable for y and solvable for $x$and 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 $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals 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 of linear 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:

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

Reference Books:

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

Course Name: Environmental Science
Course Code: HU 201
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	PO 2	PO 3	PO 4	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.
Waste Water 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: HU202
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: Data Structures and Algorithms Lab

Course Code: IT291
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	**Develop** programs using arrays and linked lists to solve basic linear data structure problems.
CO2	**Apply** stack and queue operations using both array and linked list.
CO3	**Design** non-linear data structures like trees and graphs through traversal, searching, and sorting techniques.
CO4	**Analyze** the performance of searching and sorting algorithms with respect to time complexity.
CO5	**Apply** hashing techniques and collision resolution strategies for efficient data access and retrieval.

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 Lists	Implement doubly linked and circular linked list with 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 Title: Object Oriented Programming With Java Lab

Course Code: IT292
Contact Hours: 0:0:3
Credits: 1.5

Course Objectives

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

O1 Understand basic of Object Oriented Programming.

O2 Understanding the features of Java.

O3 Enable students to write Java program and develop projects

Course Outcomes (COs):
After successful completion of the course the students will be able to

CO1	**Apply** object oriented programming concepts in designing programs.
CO2	**Apply** basic to advanced features of Object Oriented Programming for problem solving
CO3	**Analyze** different dimensions of a problem and provide optimal solutions.
CO4	**Evaluate** and analyze different solution based on object oriented concepts.
CO5	**Implement** solutions of real-life problems in the field of Information Technology.

Course Content

Module 1: Basic Program introduction
Writing simple java program, compiling and running. Understanding the main () method.
Module 2: Basic Java Concepts
Using basic java token, control structures. Illustrating class objects, constructor, final, finalize. Understanding Arrays and hands on application using array. Understanding and writing methods. Static and non static concepts.
Module 3: Reusable properties
Class Relationship. Using inheritance
Creating abstract classes, interfaces.
Module 4: String
String handling, Basic string handling concepts
Module 5: Exception and Threading:
Illustrating exception handling Illustrating multi threading applications
Module 6: IO:
Basic IO and File IO operation
Module 7: Generics and Collection
Test application using generics and collection classes
Module 8: Unit Test
JUnit Test
Module 9: Innovative Idea Development:
Applying Java new features for developing innovative projects

Textbooks:
Herbert Schildt Java Complete Reference TMH

Reference books:

Mr Kotiyana JAVA The Complete Core Reference ORACLE
Kathie Seira Head Forst Java Orielley

Course Name: Engineering Physics Lab
Course Code: PH291
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 –

9. O1: **Become familiar with scientific instruments and measurement techniques** used to determine various physical parameters of materials and systems.
10. O2: **Reinforce theoretical concepts learned in classroom physics** by performing related practical experiments and observing real-time outcomes.
11. O3: **Develop a systematic and analytical approach** to collecting, organizing, and interpreting experimental data for error analysis and validation of physical laws.
12. O4: **Engage in the experimental validation of physical laws** through laboratory activities involving classical mechanics, optics, electronics, and quantum phenomena.
13. 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	PO1 0	PO1 1	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)

COURSE NAME: ENGINEERING GRAPHICS & COMPUTER AIDED DESIGN LAB
COURSE CODE: ME294
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Basic knowledge of geometry

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
CO3: Understand the concepts of engineering scales, projections, sections.
CO4: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints
CO5: Produce part models; carry out assembly operation and represent a design project work.

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 their presentation 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.

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

Course Name: **Communication and Presentation Skill**
Course Code: **HU291**
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.

3rd Semester

2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	IT301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	IT302	Formal Language and Automata Theory	3	0	0	3	3
3	ENGG	Major	IT303	Software Engineering	2	0	0	2	3
4	ENGG	Minor	EC(IT)301	Analog and Digital Electronics	3	0	0	2	3
5	SCI	Multidisciplinary	M(IT)301	Discrete Mathematics	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IT391	Computer Organization and Architecture	0	0	2	2	1.5
2	ENGG	Skill Enhancement Course	IT392	Python Programming Lab	0	0	3	3	1.5
3	ENGG	Major	IT393	Software Engineering	0	0	2	2	1.5
4	ENGG	Minor	EC(IT)391	Analog and Digital Electronics	0	0	2	2	1.5
5	HUM	Ability Enhancement Course	HU(IT)391	Soft Skill andAptitude	0	0	1	1	1
Total of Theory, Practical								28	21

Course Name: **Computer Organization and Architecture**
Course Code: **IT301**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Concept of basic components of a digital computer, Basic concept of Fundamentals & Program structures.

Course Outcome:

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

CO1 Apply the operational concepts for instruction execution, arithmetic operations, control signals, memory operations and data transfer methods on various problems.

CO2 Analyze types of addressing modes, interrupts, arithmetic and logic circuits, memory, pipeline performance and bus architectures and its timing diagrams.

CO3 Develop technological aspects on computer organization and architecture to solve complex problems.

CO4 Evaluate the quality of something based on its adequacy, value, logic.

CO5 Design various processor architecture for computer system using Pipelining and Timing Diagram
technique.

CO-PO Mapping:

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

Course Contents:

Module I: [**6L]**
Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes.

Module II: [6L]
Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. Design of ALU. Fixed point multiplication -Booth's algorithm.
Fixed point division - Restoring and non-restoring algorithms. Floating point - IEEE 754 standard.

Module III: [6L]
Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization, static and dynamic memory, memory hierarchy, associative memory. Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

Module IV: [8L]
Design of control unit - hardwired and micro programmed control. Introduction to RISC architectures. RISC vs CISC architectures.
I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques.

Module V: [5L]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures. Array and vector processors.

Module VI: [5L]
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Textbooks:

1. Mano, M.M., “Computer System Architecture”, PHI.
2. Kai Hwang”Advance Computer Architecture” McGraw Hill
3. Behrooz Parhami “ Computer Architecture”, Oxford University Press Nicholas P Carter”Computer Architecture & Organization” McGraw Hill,

Reference Books:

1. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill, Hamacher, “Computer Organisation”, McGraw Hill,
2. N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers” Chaudhuri P. Pal, “Computer Organisation & Design”, PHI,
3. P N Basu- “Computer Organization & Architecture” , Vikas Pub

Course Name: **FORMAL LANGUAGE AND AUTOMATA THEORY**
Course Code: **IT302**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Elementary discrete mathematics including the notion of set, function, relation, product, partial order, equivalence relation, graph & tree.

Course Objective:
Being familiar with a broad overview of the theoretical foundations of computer science.

Course Outcome:

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

CO1 Understand situations in related areas of theory in computer science.

CO2 Model, compare and analyze different computational models using combinatorial methods and Identify limitations of some computational models and possible methods of proving them.

CO3 Analyze rigorously formal mathematical methods to prove properties of languages, grammars and Automata.

CO4 Construct algorithms for different problems and argue formally about correctness on different restricted Machine models of computation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	-	-	-	-	-	-	-	3	2	-	1
CO2	2	3	3	3	-	-	-	-	-	-	-	3	2	-	2
CO3	3	3	3	2	-	-	-	-	-	-	-	3	2	-	2
CO4	3	3	2	3	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Module I: [**10L]**
Fundamentals: Definition of Automata, Use of Automata. Definition of sequential circuit, block diagram, mathematical representation, and concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model Finite state machine: Definitions, capability & state equivalent, Finite memory definiteness, testing table & testing graph. Minimization of FSM-completely specified and incompletely specified (Merger graph, Merger table, Compatibility graph). Limitations of FSM Application of finite automata, Finite Automata with Output-Moore & Mealy machine

Module II: [10L]
Deterministic finite automaton and non-deterministic finite automaton. Transition diagrams and Languagrecognizers. Chomsky Hierarchy. Finite Automata: NFA with Î transitions - Significance, acceptance of languages. NFA to DFA conversion. DFA minimization. Myhill-Nerode theorem Regular Languages: Regular sets. Regular expressions,
identity rules. Arden ‘s theorem state and prove Constructing Finite Automata for a given regular expression, Regular string accepted by NFA/DFA. Pumping lemma of regular sets. Grammar Formalism: Regular grammars-right linear and left linear grammars. Equivalence between regular linear grammar and FA.

Module III: [10L]
Introduction to Context free grammars, Derivation trees, sentential forms. Right most and leftmost derivation of strings. Basic applications of the concept of CFG, Ambiguity in context free grammars. Minimization of Context Free Grammars: Removal of useless, null and unit productions. Chomsky normal form and Greibach normal form. Pumping Lemma for Context Free Languages. Enumeration of properties of CFL. Closure property of CFL. Push down Automata: Push down automata, definition. Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA,

Module IV: [6L]
Turing Machine: Turing Machine, definition, model, Design of TM, TM as language accepter, TM as transducers. Recursively enumerable and recursive languages. Computable functions. Church‘s hypothesis, counter machine, Types of Turing machines Universal Turing Machine, Decidability, Undesirability, Halting problem.

Textbooks:

1. “Theory of Computer Science-Automata Languages and Computation”, Mishra andChandrashekaran,2nd edition,PHI
2. “Switching&FiniteAutomata”,ZVIKohavi,2ndEdn.,TataMcGrawHill
3. “An Introduction to Computing”, Peter Linz, Narosa.

Reference Books:

1. Introduction to Automata Theory Language and Computation”, Hopcroft H.E.and Ullman J.D

Course Name: **SOFTWARE ENGINEERING**
Course Code: **IT303**
Contact: (2:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites:
Mathematics, Data Structure and Basic Computations.

Course Objective:
In this course, students will gain a broad understanding of the discipline of software engineering and its application to the development of and management of software systems. Knowledge of basic software engineering methods and practices and their appropriate application.

Course Outcome:

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

CO1 Identify the need for engineering approach to software development and various processes of requirements analysis for software engineering problems.

CO2 Apply software engineering principles, techniques to develop and maintain, large scale software systems

CO3 Analyze and design of complex systems and meet ethical standards, legal responsibilities

CO4 Produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis as an effective member or leader of software development team to achieve personal and team goals

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	2	-	1	1	-	-	-	-	2	-	-	1
CO2	3	2	2	1	-	2	2	-	1	-	1	2	-	-	-
CO3	3	3	3	2	-	-	-	-	2	2	1	2	3	3	2
CO4	3	2	3	2	-	3	2	2	3	2	2	2	3	3	3

Course Contents:

Module I: [**2L]**
Introduction : Definition of Software Engineering, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs. Software Engineering, Human cognition mechanism, Software Engineering principle- abstraction and decomposition

Module II: [4L]
Software Development Life Cycle (SDLC) models : Water fall model, V-shape Model, Prototyping Model, Spiral Model, RAD Agile Model, Verification and Validation.

Module III: [7L]
Software Project Management: Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning.

Module IV: [3L]
Requirement analysis and specification: SRS, Requirement gathering and specification, Functional requirement, Traceability

Module V: [8L]
Software Design: Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements. Object oriented design- class and relationship, UML diagrams.

Module VI: [7L]
Coding and Testing: Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclometric complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing.

Module VII: [2L]
Software Reliability and Quality Management: Reliability, Hazard, MTTF, Repair and Availability, Software quality, Software reliability and fault- tolerance, six-sigma.

Module VII: [3L]
Computer-aided software engineering:
Computer-aided software engineering (CASE)-environment and benefit. Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001.

Textbooks:

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach",
3. Seventh Edition, Mc Graw-Hill International Edition

Reference Books:

1. Ian Somerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Software Engineering: Iyan Somerville, 7th Edition

Course Name: **ANALOG AND DIGITAL ELECTRONICS**
Course Code: **EC(IT)301**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Mathematics, Physics, Basic Electronics.

Course Objective: The objective of the course is to prepare students to perform the analysis and design of various digital and analog electronic circuits.

Course Outcome:

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

CO1 Apply the basic concept of analog and digital electronics, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques.

CO2 Analyze the characteristics of analog and digital circuits.

CO3 Judge working principles of basic Analog and Digital electronics circuits for different applications.

CO4 Design different analog circuits, combinational logic devices and sequential logic devices like counters and registers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	2	2	1	-
CO3	2	3	2	3	-	-	-	-	-	-	-	2	2	2	-
CO4	2	2	3	2	-	-	-	-	-	-	-	2	2	3	-

Course Contents:

Module I: [**10L]**
Analog Electronics: Diodes, Transistors, Feedback and Op-amp, Power Amplifiers – Class A, B, AB and C - basic concepts, power, efficiency calculation; Phase Shift, Wein Bridge oscillators; 555 Timer and Multivibrators; Schimtt Trigger circuit.

Module II: [10L]
Introduction to Number Systems: Introduction to Number Systems: Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic; Boolean algebra; Various logic gates; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-MAP method and Quin Mc-Clusky Method.

Module III: [6L]
Combinational Circuits: Adder and Subtractor; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker.

Module IV: [6L]
Sequential Circuits: Sequential Circuits: Basic Flip-flop & Latch; SR, JK, D, T and JK Master-slave Flip Flops Registers (SISO, SIPO, PIPO, PISO); Ring counter, Johnson counter; Basic concept of Synchronous and Asynchronous counters; Design of synchronous and asynchronous Mod N Counter.

Module V: [2L]
A/D and D/A conversion techniques: A/D and D/A conversion techniques: Basic concepts of R-2R, A/D and D/A; successive approximation ADC.

Module VI: [2L]
Logic families: Logic families: TTL, ECL, MOS and CMOS - basic concept

Textbooks:

1. 'Digital Circuits and Design', Salivahanan, S. Arivazhagan, Vikas Publishers
2. 'Electronics Fundamentals and Applications', D. Chattopadhyay, P. C. Rakshit, New Age International Publishers

Reference Books:

1. 'Digital Design', M. Morris Mano, Pearson Education

Course Name: **Discrete Mathematics**
Course Code: **M(IT)301**
Contact: (2:0:0)
Total Contact Hours: 24
Credit: 2

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.

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Course Objective:
O1: Develop a foundational understanding of algebraic structures like groups, rings, and fields to support the design of secure systems in various computational and information-related domains.

O2: Gain the proficiency in applying graph-theoretic concepts for solving problems across a range of computational and engineering domains.

O3: Enhance the analytical and problem-solving skills through the application of algebraic and graph models in diverse computational contexts.

Course Outcome:

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

CO1 Apply the fundamental properties of groups, rings, and fields to solve problems involving algebraic structures in computational contexts.
CO2 Apply graph-theoretic methods to represent and solve problems involving relationships and connectivity.
CO3 Analyze the structural properties of groups, rings, and fields to investigate and interpret complex patterns and behaviors in computational systems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	1				3
CO2	3	2	-	-	-	-	-	-	-	-	1				3
CO3	3	3	1	1	-	-	-	-	-	-	2				3
CO4	3	3	1	1	-	-	-	-	-	-	2				3

Course Contents:

Module-I: Algebraic Structures [12L]
Group, Commutative Group, Order of a Group, Order of an element of a Group, Properties of Group, Subgroup, Cyclic group, Coset, Lagrange's theorem, Normal subgroup, Permutation group, Symmetric group(S3). Ring, Properties of Ring, Sub ring, Integral Domain, Field.

Module -II: Graph Theory [12L]
Graph: Properties and Theorems, Digraphs, Weighted Graph, Connected and Disconnected Graph, Bipartite Graph, complement of a Graph, Regular Graph, Complete Graph, Walk, Path, Circuit, Euler Graph, Hamiltonian Circuit, Adjacency and Incidence Matrices of a Graph, Tree: Properties and Theorems, Binary Tree, Spanning Tree, Minimal Spanning Tree, Dijkstra's algorithm, 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 Oriented Approach, 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., Tata Mcgraw-Hill

Course Name: **Computer Organization and Architecture Lab**
Course Code: **IT391**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites: Basic concept of Digital Electronics. Course Objective: Implementation of digital logic using XLINX tool. Simulate digital circuit design using XLINX tool

Course Outcome:

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

CO1 Apply the knowledge of mathematics, science, and engineering in simulation.

CO2 Apply quantum mechanics in explaining quantum bits, formation of energy bands.

CO3 Use Hardware Description Language (HDL) in order to implement skills in designing Architectural solutions and describing designs using VHDL

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	-	-	-	3	-	-	-
CO2	2	1	2	2	2	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	2	3	-	-	-	2	-	-	2	2	-	2

Course Contents:

1. Implementation of simple 8-to-1 line and 4-to-1 line Multiplexer
2. Realization of the basic gates (AND, OR, NOR, NOT, NAND).
3. Implementation of HALF ADDER circuit using basic gates and verify its output.
4. Implementation of FULL ADDER circuit using basic gates and verify its output.
5. Implementation of HALF SUBTRACTER circuit using basic gates and verify its output.
6. Implementation of FULL SUBTRACTER circuit using basic gates and verify its output.
7. Implementation of 1:4 De-Multiplexer and 1:8 De-Multiplexer
8. Implementation of 2:4 decoder and 3:8 Decoder using logic gates.
9. Implementation of 4:2 Encoder and 8:3 En coder using logic gates.
10. Implementation of Binary to its corresponding Gray conversion and vice versa.
11. Implementation of 4-bit Comparator.
12. Implementation of D-Flip-Flop and SR- Flip-Flop,JK Flip-Flop and T Flip-Flop.
13. Implementation of Circuit for 8-bit adder.
14. Implementation of ALU Design.
15. Implementation of CPU Design..

Text Books:

1. Mano, M.M., “Computer System Architecture”, PHI.
2. Kai Hwang”Advance Computer Architecture” McGraw Hill
3. Behrooz Parhami “ Computer Architecture”, Oxford University Press
4. Nicholas P Carter”Computer Architecture & Organization” McGraw Hill,

Reference Book:

1. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
5. Hamacher, “Computer Organisation”, McGraw Hill,
6. N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers”

Course Name: **Python Programming Lab**
Course Code: **IT392**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites: Basic knowledge of computers, basic knowledge of programming.
Course Objective:
Use basic concept of python programming language for developing solutions, Develop small projects.

Course Outcome:

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

CO1 Apply different Programming Concept for application development

CO2 Analyze the application of different features of Python in application development

CO3 Evaluate the performance of different solutions using python to find an optimal solution

CO4 Develop different applications using Python

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	-	2	-	-	-	-	-	-	3	3	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	-	2
CO3	3	2	1	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	2	-	-	3	3	-	2

Course Contents:

Module I: Introduction to Python
Installation of Python, Understanding the environment setup of python, Different phases for execution of python program, Basic features of Python, Major Application areas, Advantages and disadvantages.

Module II: Variable and Functions
Values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments

Module III: Control Structure
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion;

Module IV: List Tuple String
Packages Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Strings, Concepts of packages

Module V: Object Oriented Concepts
Defining class, creation of objects, Built in class, garbage collection, operator overloading, Inheritance.

Module VI: Exception Handling
Exception Handling, Assertion, except clause, try-finally, exception with arguments, raising exception, and user defined exception

Module VII: GUI Programming
Turtle Graphics, Writing GUI Programs

Module VIII: File Operations
File related modules in Python, File modes and permissions, Reading & Writing data from a file, redirecting output streams to files, Working with directories, CSV files and Data Files

Module IX:
ODBC and Python, Working with Databases in MySQL, Working with Tables in MySQL, Working with SQLite Database

Module X: Innovative Idea Development:
Applying Python features for developing innovative projects

Textbooks:
1. Core Python Programming by R. Nageswara Rao

Reference books:
1. Python for Education', Ajith Kumar B. P., Inter University Accelerator Center, New Delhi, 2010.
2. 'Python Cookbook: Recipes for Mastering Python 3', 3rd Edition - David Beazley & Brian K. Jones, O'Reilly Media, Inc., 2013

Course Name: **SOFTWARE ENGINEERING LAB**
Course Code: **IT393**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites:
Familiar with MS Office Package and Basic Computations.

Course Objective:
Demonstrate the UML diagrams with ATM system descriptions; demonstrate the working of software testing tools with c language, Understanding Project Planning Tools.

Course Outcome:

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

CO1 Make use of efficient models for development of software for various projects.

CO2 Analyze a specification and examine the corresponding design for developing software.

CO3 Produce efficient, reliable, robust and cost-effective software solutions Designing valid test cases.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	-	-	-	1	-	-	2	3	2	1
CO2	3	3	2	3	3	-	-	-	2	-	-	1	2	3	2
CO3	3	3	3	3	3	2	2	3	3	-	3	2	3	3	2

Course Contents:

List of Experiments:

1. Identifying the Requirements from Problem Statements
2. Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
3. Estimation of Project Metrics
4. Project Estimation Techniques -COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
5. Modelling UML Use Case Diagrams and Capturing Use Case Scenarios
6. Use case diagrams, Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include Relationship, Extend Relationship, Generalization Relationship, Identifying Actors, Identifying Use cases, Guidelines for drawing Use Case diagrams
7. Identifying Domain Classes from the Problem Statements
8. Introduction to selenium tool for software testing.
9. JUnit, Static analysis, Junit Framework
10. Prepare a SRS document in line with the IEEE recommended standards
11. Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case.
12. Draw the sequence diagram for any two scenarios.
13. Draw the collaboration diagram.
14. Draw the state chart diagram & component diagram.
15. Draw the deployment diagram.

Textbooks:

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition

Reference books:

1. Ian Somerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Software Engineering: Iyan Somerville, 7th Edition

Course Name: **ANALOG AND DIGITAL ELECTRONICS LAB**
Course Code: **EC(IT)391**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisite:
Mathematics, Basic Electronics, Concepts of Basic Electrical components.

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

O1: illustrate the students different electronic circuit and their application in practice.

Course Outcome:

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

CO1 Make use of analog and digital electronic circuit devices.

CO2 Examine the characteristics of different analog and digital circuits.

CO3 Construct different combinational and sequential circuits using basic logic gates.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	2	-	-	-	-	-	-	3	1	-	1
CO2	2	2	1	2	2	-	-	-	-	-	-	2	2	-	2
CO3	2	2	2	3	2	-	-	-	2	-	-	2	2	-	2

List of Experiments:
1.Design of a Class A amplifier.
2.Design of a Phase-Shift Oscillator.
3.Design of a Schmitt Trigger using Op-amp.
4.Realization of basic logic gates.
5.Design of Half and Full adder and Half and Full Subtractor
6.Construction of simple Multiplexer & Demultiplexer circuits using logic gates.
7.Construction of simple Decoder & Encoder circuits using logic gates.
8.Realization of SR / JK / D/ T flip flops using logic gates.
9.Design of Shift Register using J-K / D Flip Flop.
10.Realization of Synchronous Up/Down counters.
11.Design of MOD- N Counter (Synchronous and Asynchronous).
12.Study of DAC and ADC.

Text Books:
• 'Digital Circuits and Design', Salivahanan, S. Arivazhagan, Vikas Publishers
• 'Electronics Fundamentals and Applications', D. Chattopadhyay, P. C. Rakshit, New Age International Publishers

Reference Books:
• 'Digital Design', M. Morris Mano, Pearson Education

Course Name: **Soft Skill and Aptitude**
Course Code: **HU(IT) 391**
Contact: (0:0:2)
Total Contact Hours:24
Credit: 1

Prerequisite:
Basic ability of soft skills.

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

O1: enhance soft skills

Course Outcome:

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

CO1 Make use of analog and digital electronic circuit devices.

CO2 Examine the characteristics of different analog and digital circuits.

CO3 Construct different combinational and sequential circuits using basic logic gates.

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

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	1
CO2	2	-	-	-	-	2	-	-	-	3	-	-	-	-	1
CO3	-	-	-	-	-	3	-	-	-	3	-	-	-	-	1
CO4	3	-	-	-	-	2	-	-	-	3	-	-	-	-	1

Course Content
Module I: – Introduction to Soft Skills
The Skills of Interpersonal Communication. 2. Team Behavior. 3. Time Management Skills

Module II- Verbal Ability: Reading
Enhancing reading speed and vocabulary enhancement through intensive practice of placement test- based reading passages.

Module III – Verbal Ability Test Patterns
Introducing Verbal Ability tests—Test Question Types: Synonyms and Antonyms, Error Spotting/Sentence Improvement, Analogies and Para Jumbles.

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

Text Books:

1. Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition.
2. New Delhi: Oxford University Press, 2015.
3. Mark Ibbotson. Cambridge English for Engineering. Cambridge:
4. Cambridge University Press,2008.
5. Mark Ibbotson. Professional English in Use: Engineering. Cambridge: ,2009.
6. John Seeley. Writing Reports. Oxford: Oxford UniversityPress,2002.
7. DianaBooher.E-writing:21stCenturyTools forEffectiveCommunication.Macmillan,2007.
8. Michael Swan. Practical English Usage. Oxford: OUP, 1980.

4th Semester

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT401	Operating System	3	0	0	3	3
2	ENGG	Major	IT402	Advanced Artificial Intelligence	3	0	0	3	3
3	ENGG	Major	IT403	Design Analysis & Algorithm	3	0	0	3	3
4	ENGG	Minor	M(IT)401	Probability & Statistics	2	0	0	2	2
5	ENGG	Minor	EC(IT)401	Microprocessor & Microcontroller	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IT491	Operating System Lab	0	0	3	3	1.5
2	ENGG	Major	IT492	Advanced Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	IT493	Design Analysis & Algorithm Lab	0	0	3	3	1.5
4	ENGG	Major	IT494	R-Programming Lab	0	0	2	2	1.5
5	ENGG	Minor	EC(IT)491	Microprocessor & Microcontroller Lab	0	0	3	3	1.5
6	ENGG	Ability Enhancement Course	HU(IT)491	IT Workshop Lab (SciLab / MATLAB/ C++)	0	0	3	3	1.5
Total of Theory, Practical								27	22

Course Name: **Operating System**
Course Code: **IT401**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Basic knowledge of computers, Basic knowledge of programming

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

O1: learn basic of operating system
O2: Understand the different types of Operating System, Memory management and process management,

Course Outcome:

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

CO1 Apply various concepts of CPU scheduling, memory management, synchronization and file management.

CO2 Analyze different algorithms of process scheduling, disk scheduling, OS structures and services.

CO3 Evaluate different operating system approaches.

CO4 Design solutions for complex problems related to Process and Memory Management.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	-	2
CO4	3	2	2	3	-	-	-	-	-	-	-	3	3	-	3

Course Content:

Module-I: [6L]

Introduction: Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and security, Kernel data structures, computing environments. Operating System Services, User Operating System interface.

Module II: [15L]

Process: Processes: Process Concept, Process Scheduling, Interprocess communication.
Process Synchronization: The critical section problem, Peterson's solution, Mutex locks, Semaphores,
Classical problems of synchronization.Multithreaded Programming: Multithreading models.
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Module III: [10]

Memory: Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.
Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing.

Module IV: [3L]

Disk Performance: Introduction, Why disk scheduling is necessary, Disk scheduling strategies, rotational optimization.

Module V: [2L]

File and Database Systems: Free space management, File access control.

Textbook:

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

Reference Book:

1. Operating Systems, A Concept-Based Approach, by DM Dhamdhere, 3rd Edition, Tata Mcgraw-Hill, 2012.
2. Modern Operating Systems, by Andrew S. Tanenbaum and Herbert Bos, 4th Edition, Pearson, 2014.
3. UNIX complete reference by Herbert Schildt, 2nd edition McgrawHill2.
4. Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.

Course Name: **Advanced Artificial Intelligence**
Course Code: **IT402**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites:

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

O1: To introduce the fundamental concepts and techniques of Artificial Intelligence and equip students with practical problem-solving skills using classical and modern AI algorithms. To develop understanding of various AI learning and expose students to real-world AI applications and emerging areas.

Course Outcome:

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

CO1	Describe the fundamental concepts of Artificial Intelligence, intelligent agents, and search strategies used for problem-solving.
CO2	**Apply** uninformed and informed search algorithms, constraint satisfaction techniques, and game strategies to solve real-world and simulated AI problems.
CO3	**Analyze** knowledge representation methods and various learning techniques (e.g., decision trees, Bayesian learning, genetic algorithms) for building intelligent systems.
CO4	**Evaluate and propose** appropriate AI techniques such as planning, deep learning, or reinforcement learning for solving complex problems while considering ethical implications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	--	--	--	--	--	--	1	1	2	3	1
O2	2	1	3	3	--	--	--	--	--	--	1	2	1	3	3
O3	2	3	1	3	--	--	--	--	--	--	2	2	3	1	3
O4	2	3	1	3	--	1	2	2	--	--	2	2	3	1	2

Module I: Introduction to Artificial Intelligence [3L]
Linear Algebra, Statistics and probability. What is AI? Motivation and real-world impact. Types of AI: Narrow, General, Superintelligence. AI vs Human Intelligence. Agents: What are agents? How do they perceive and act? Types of environments (fully/partially observable, deterministic/stochastic).

Module II: Problem Solving Using Search [6L]
Understanding Search Problems: Real-life examples like route planning, puzzles, games. State space, initial state, goal state, transitions. Uninformed (Blind) Search Techniques: Breadth-First Search (BFS), Depth-First Search (DFS), Uniform-Cost Search (UCS), Informed (Heuristic-

Based) Search: Concept of heuristics (guessing smartly), Designing good heuristics. A* Search and its optimality

Module III: Advanced Search and Optimization Techniques [7L]
Local Search Algorithms: Hill Climbing (simple local optimization), Simulated Annealing (better global optimization), Beam Search (limited memory approach). Adversarial Search (Games): Two-player games: chess, tic-tac-toe, Minimax Algorithm, Alpha-Beta Pruning (speed up game AI), Handling partially observable and non-deterministic games. Problem Decomposition: Solving complex problems using AND-OR Graphs, AO and AO* algorithms for hierarchical planning

Module IV: Constraint Satisfaction Problems (CSP) [3L]
What are CSPs? (e.g., Sudoku, Map Coloring), Solving CSPs with: Backtracking Search, Forward Checking, Arc Consistency (AC-3 algorithm).

Module V: Knowledge Representation and Reasoning [6L]
Representing Knowledge with: Propositional Logic (basic true/false statements), First-Order Logic (FOL) (relations, variables, quantifiers), Logical Inference: Modus ponens, resolution, backward & forward chaining. Basics of Planning in AI: State-space planning, Goal stack planning, STRIPS (Stanford Research Institute Problem Solver)

Module VI: Machine Learning and AI Learning Techniques [5L]
Overview of how AI systems learn from data, Decision Trees (e.g., ID3 algorithm). Bayesian Learning (probabilistic reasoning under uncertainty), Metaheuristic Algorithms: Genetic Algorithms (GA) for optimization problems, Basics of Evolutionary Computation

Module VII: Advanced AI Techniques and Real-world Applications [6L]
Neural Networks & Deep Learning Overview, Basics of perceptron, multilayer networks, Real-life applications in image recognition. Natural Language Processing (NLP): Chatbots, text classification, sentiment analysis, Computer Vision: Image classification, object detection, Reinforcement Learning: Agents that learn by interacting with the environment (e.g., self-driving cars, games like Atari), Explainable AI (XAI): Importance of transparency and trust in AI systems

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 McGrawHill.

Reference Books

3. Artificial Intelligence for Students, Subhasree Bhattacharjee, Shroff Publishers & Distributors Pvt. Ltd. 1st Edition.
4. Artificial Intelligence & Intelligent Systems, N.P Padhy, Oxford University Press. Illustrated Edition.

Course Name: **Design Analysis & Algorithm**

Course Code: **IT403**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisite: Discrete Mathematics Data Structure and Basic Programming Knowledge

Course Objective: The objective of the course is to

O1: study paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm
O2: design in practice, use different computational models, order notation and various complexity measures
O3:analyze the complexity/performance of different algorithms.

Course Outcome:

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

CO1 Understanding the complexity of the basic algorithms for the classic problems in various domains.

CO2 Apply the classic algorithms to solve different problems

CO3 Evaluate existing algorithms by calculating the time complexity

CO4 Design algorithm to solve various problems in different domains

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	-	-	-	-	-	-	-	-	2	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	3	2	-	-	-	-	-	-	-	1	-	2	2

Course Content:

Module I: [2L]
Introduction: Time and Space Complexity, Different Asymptotic notations and their mathematical significance

Module II : [8L]
Divide and Conquer: Basic method, use, Merge Sort, Quick Sort and their complexity, Heap Sort and its complexity Dynamic Programming: Basic method, use, Matrix Chain multiplication, All pair shortest paths, single source shortest path, Strassen's matrix multiplication algorithm.

Module III: [8L]
Backtracking: Basic method, use, 8 queens problem, Graph coloring problem. Greedy Method: Basic method, use, Knapsack problem, traveling sales man, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.

Module IV: [3L]
Branch and bound technique: integer programming, 0/1 knapsack problem

Module V: [4L]
Disjoint set manipulation: Set manipulation algorithm like UNION-FIND, union by rank. String matching problem: Different techniques – Naive algorithm, Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Module VI: [6L]
Amortized Analysis: Aggregate, Accounting, and Potential Method. Network Flow: Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Module VII: [5L]
Notion of NP-completeness: P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only). Approximation Algorithms: Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes.

Text books:

1. A. Aho, J. Hopcroft and J. Ullman "The Design and Analysis of Algorithms"
2. D. E. Knuth "The Art of Computer Programming", Vol. 3
3. E. Horowitz and Shani "Fundamentals of Computer Algorithms" Reference books:
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms

Reference books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms

Course Name: **Probability & Statistics**
Course Code: **M(IT)401**
Contact: (2:0:0)
Total Contact Hours: 24
Credit: 2

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

O1: Develop a strong foundation in probability theory and random variables to model computational uncertainty and data-driven phenomena.

O2: Gain the ability to work with discrete and continuous probability distributions, and apply statistical techniques for data interpretation and decision-making

O3: Build analytical skills to quantify relationships among variables through correlation and regression, supporting real-world applications in computing and engineering domains.

Course Outcome:

After successful completion of the course, the 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 appropriate statistical measures such as central tendency and dispersion mean, median, variance, and standard deviation to summarize real-world data sets for effective data analysis.
CO3	Analyze the characteristics of random variables and distributions using moment-generating functions and mathematical expectation to draw meaningful inferences.
CO4	Analyze the interrelationship between variables using correlation and regression techniques to support predictive modeling and system evaluation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	1				3
CO2	3	2	-	-	-	-	-	-	-	-	1				3
CO3	3	3	1	1	-	-	-	-	-	-	2				3
CO4	3	3	1	1	-	-	-	-	-	-	2				3

Course Contents:

Module-I: Probability and Random Variables [12L]

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: Statistics [12L]

Measures of Central Tendency: Mean, Median, Mode.

Measures of Dispersion: Range, Mean deviation, Variance, Standard deviation.

Correlation: Bivariate Data, Scatter Diagram, Methods of studying correlation – Karl-Pearson's coefficient of correlation.

Regression: Regression lines, Regression equations, Regression coefficients.

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., 9th Edition; John Wiley & Sons, 2006.

Reference Books

1. Schaum's Outline in Probability (2nd Ed.), 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.

Course Name: **Microprocessor & Microcontroller**

Course Code: **EC(IT)401**

Contact: (2:0:0)
Total Contact Hours: 36
Credit: 2

Prerequisite: Digital Electronics, Computer Programming, Computer Organization and Architecture

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

O1: develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques

Course Outcome:

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

CO1 Correlate the architecture, instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085

CO2 Apply instructions for assembly language programs of 8085, 8086 and 8051

CO3 Analyze Micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	-	2

Course Contents:

Module I: [10L]

Introduction to Microcomputer based system: History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. Architecture of 8085 Microprocessor, Pin description of 8085. Address/data bus De multiplexing, Status Signals and the control signals. Instruction set of 8085 microprocessors, Addressing modes Timing diagram of the instructions (a few examples).

Module II: [10L]

Assembly language: programming with examples, counter and Time Delays, Stack and Subroutine Interrupts of 8085 processor (software and hardware), I/O Device Interfacing I/O Mapped I/O and Memory Mapped I/O, Serial (using SID and SOD pins and RIM, SIM Instructions) and transfer

Module III: [8L]

The 8086 microprocessors: Architecture, Addressing modes, interrupts. Introduction to 8051

Microcontroller –Architecture, Pin Details Addressing modes, Instruction set, Examples of Simple Assembly Language.

Module IV: [8L]
Memory interfacing with 8085, 8086 Support IC chips- 8255, 8251, 8237/8257, 8259,
Support IC chips- 8255, 8251, 8237/8257, 8259, Interfacing of 8255 PPI with 8085 and Microcontroller 8051. Brief introduction to PIC microcontroller(16F877)

Text books:

1.Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2.Fundamentals of microprocessor and microcontroller- B.Ram
3.An Introduction to Microprocessor and Applications –Krishna Kant, Macmillan

Reference books:

1.Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2.8086 Microprocessor –K Ayala, Cengage learning
3.Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
4.The 8051 microcontrollers – Uma Rao and Andhe Pallavi, Pearson
5.The 8051 Microcontroller and Embedded System- Mazidi
6.The 8051 microcontroller - K. Ayala, Thomson

Course Name: **Operating System Lab**
Course Code: **IT491**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites:
Basic knowledge of computers, Basic knowledge of programming

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

O1: understand and appreciate the principles in the design and implementation of operating systems software.

Course Outcome:

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

CO1 Experiment with Unix commands and shell programming

CO2 Analyze the best CPU scheduling algorithm, memory management algorithm, synchronization techniques for a given problem instance

CO3 Develop algorithm for deadlock avoidance, detection and file allocation strategies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	-	-	-	-	-	-	2	2	-	1
CO2	2	3	2	3	3	-	-	-	-	-	-	3	3	-	1
CO3	3	3	3	3	3	-	-	-	2	-	-	3	3	-	3

Course Content:

Module I: Basic Commands of UNIX:
File and Directory Related commands, Process and status information commands, Text related commands, File Permission commands, Pipes and filters, Managing Local Users and Groups

Module II: Shell programming
Variables, Control Structure, Loop, Array, Function

Module III: System Calls
I/O and Unix System Calls

Module IV: Process Synchronization
Implementation of Classical Synchronization problems using Semaphore

Module V: CPU Scheduling Algorithm

Module VI: Memory Management Schemes

Module VII:.Page Replacement Algorithm

Textbooks:

1. Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system", Revision8.
2. Sumitabha Das , UNIX Concepts and Applications, Tata McGraw-Hill

Course Name: **Advanced Artificial Intelligence Lab**
Course Code: **IT492**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites:

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

O1:To introduce the fundamental concepts and techniques of Artificial Intelligence and equip students with practical problem-solving skills using classical and modern AI algorithms. To develop understanding of various AI learning and expose students to real-world AI applications and emerging areas.

Course Outcome:

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

CO1	Describe the fundamental concepts of Artificial Intelligence, intelligent agents, and search strategies used for problem-solving.
CO2	**Apply** uninformed and informed search algorithms, constraint satisfaction techniques, and game strategies to solve real-world and simulated AI problems.
CO3	**Analyze** knowledge representation methods and various learning techniques (e.g., decision trees, Bayesian learning, genetic algorithms) for building intelligent systems.
CO4	**Evaluate and propose** appropriate AI techniques such as planning, deep learning, or reinforcement learning for solving complex problems while considering ethical implications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	--	--	--	--	--	--	1	1	2	3	1
CO2	2	1	3	3	--	--	--	--	--	--	1	2	1	3	3
CO3	2	3	1	3	--	--	--	--	--	--	3	2	3	1	3
CO4	2	3	1	3	--	1	2	2	--	--	3	2	3	1	2

Course Contents:

1. Introduction to AI Tools and Environments: Setup and basic usage of Python, Jupyter Notebook, and libraries like NumPy, SciPy, scikit-learn, TensorFlow/Keras.
2. Uninformed Search Algorithms: Implement BFS, DFS, and UCS for problem-solving (e.g., maze or puzzle solver).

3. Informed Search Algorithms: Implement A* Search with heuristic design and performance comparison.

4. Local Search Techniques: Implement Hill Climbing and Simulated Annealing on optimization problems (e.g., N-Queens, TSP).
5. Game Playing Agents: Design a game-playing agent using Minimax and Alpha-Beta Pruning (e.g., Tic-Tac-Toe).
6. Constraint Satisfaction Problems: Solve CSPs like Sudoku or Map Coloring using Backtracking and Arc Consistency.
7. Knowledge Representation and Reasoning: Implement logical inference with Propositional or First-Order Logic (e.g., backward chaining).
8. Decision Tree Learning: Build and evaluate a decision tree using the ID3 or CART algorithm on a dataset.
9. Bayesian Learning: Use Naive Bayes classifier on a real dataset (e.g., email spam classification).
10. Genetic Algorithms: Solve an optimization problem using a GA (e.g., function maximization or schedule optimization).
11. Neural Networks & Deep Learning: Train a simple MLP for image classification using MNIST/CIFAR-10 dataset.
12. Natural Language Processing (NLP): Perform text classification or sentiment analysis using NLP libraries (e.g., NLTK, spaCy, Hugging Face).
13. Reinforcement Learning: Implement a simple RL environment using Q-learning (e.g., grid world, OpenAI Gym).
14. Explainable AI (XAI): Use libraries like LIME/SHAP to interpret model decisions.
15. Mini Project.

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 McGrawHill.

Reference Books

1. Artificial Intelligence for Students, Subhasree Bhattacharjee, Shroff Publishers & Distributors Pvt. Ltd. 1st Edition.
2. Artificial Intelligence & Intelligent Systems, N.P Padhy, Oxford University Press. Illustrated Edition.

Course Name: **Design Analysis & Algorithm Lab**

Course Code: **IT493**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisite: Discrete Mathematics Data Structure and Basic Programming Knowledge

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

O1: analyze and design algorithms, use different computational models, order notation and various complexity measures to analyze the performance of different algorithms.

Course Outcome:

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

CO1 Apply different algorithmic approaches for solving the problems.

CO2 Analyze a problem and design the solution for the problem and Analyze the efficiency of algorithms using time and space complexity theory

CO3 Design and Optimize the solution with respect to time complexity & memory usage

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	2	-	-	-	3	-	-	2	3	-	2
CO2	3	1	1	3	2	-	-	-	2	-	-	2	2	-	1
CO3	3	1	3	2	2	-	-	-	3	-	-	1	3	-	2

Course Content:

1.Implement Merge Sort using Divide and Conquer approach
2.Implement Quick Sort using Divide and Conquer approach
3.Find the minimum number of scalar multiplication needed for chain of matrix using dynamic programming
4.Implement all pair of shortest path for a graph (Floyd-Warshall Algorithm) using dynamic programming
5.Implement Traveling Salesman Problem using dynamic programming
6.Implement Single Source shortest Path for a graph using Bellman Ford Algorithm
7.Implement 15 Puzzle Problem using Branch and Bound technique.
8.Implement 8 Queen Problem using Backtracking.
9.Implement any one of the following problems using Backtracking: Graph Coloring Problem, Hamiltonian Problem
10.Implement any one of the following problem using Greedy method: Knapsack Problem, Job sequencing with deadlines
11.Implement KMP algorithm for string matching.
12.Implement Ford Fulkerson algorithm.

Text books:

1.Hopcroft and J. Ullman “The Design and Analysis of Algorithms”
2.D. E. Knuth “The Art of Computer Programming”, Vol. 3
3.E. Horowitz and Shani “Fundamentals of Computer Algorithms”

Course Name: **R-Programming Lab**
Course Code: **IT494**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisite: Basic knowledge of computers, basic knowledge of programming

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

O1: use basic object oriented features in coding. Enable students to develop small projects

Course Outcome:

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

CO1 Understand the basics of machine learning techniques that make it useful to real-world problems.

CO2 Apply machine learning algorithms such as supervised, semi-supervised, and unsupervised.

CO3 Analyze various machine learning techniques to investigate real world applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1	2	-	-	-	2	-	-	3	3	-	2
CO2	2	3	2	2	3	-	-	-		-	-	3	3	-	2
CO3	3	3	2	2	3	-	-	-	2	-	-	3	3	-	2

Course Content:

1.Download and install R-Programming environment and install basic packages using install.packages() command in R.
2.Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3.Write a program to find list of even numbers from 1 to n using R-Loops.
4.Create a function to print squares of numbers in sequence.
5.Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6.Implement different String Manipulation functions in R.
7.Implement different data structures in R (Vectors, Lists, Data Frames)
8.Write a program to read a csv file and analyze the data in the file in R.
9.Create pie chart and bar chart using R.
10.Create a data set and do statistical analysis on the data using R.

Textbooks:

1. Norman Matloff, The Art of R Programming, UC Davis 2009.

Course Name: **Microprocessor & Microcontroller Lab**
Course Code: **EC(IT)491**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisite: Basic Knowledge of Digital Electronics.
Course Objective: The objectives of the course are to make the students able to

O1: apply Assembly Level Programming for arithmetic-logical solutions and also to interpret the interfacing programming by conducting experiments

Course Outcome:

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

CO1 Solve small assignments using the 8085 basic instruction sets and memory mapping through trainer kit and simulator.

CO2 Evaluate 8085 assembly language programs like Addition, Subtraction, Multiplication, Square, Complement, Look up table, Copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Ascending order, Descending order etc. using trainer kit.

CO3 Create applications using 8255 trainer kit through subroutine calls and IN/OUT instructions like glowing LEDs accordingly, stepper motor rotation etc

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	1	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	2	3	-	-
CO3	3	-	-	-	3	-	-	-	-	-	-	2	2	-	2

Course Content:

1. Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including the memory map.
2. Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.
3. Programming using 8085 kit and simulator for: Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, Look up table, Copying a block of memory,
Shifting, Packing and unpacking of BCD
numbers, Addition of BCD numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit
e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.
5. Program for serial communication between two trainer kits.
    a) Interfacing of 8255: Keyboard, Stepper motor rotation.
    b) Study of 8051 Micro controller kit and writing programs

Text books:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. Fundamentals of microprocessor and microcontroller- B.Ram

Reference books:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
4. The 8051 Microcontroller and Embedded System- Mazidi

Course Name: **IT Workshop Lab(MATLAB)**
Course Code: **HU(IT)495**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisite: Basic knowledge of computers, basic knowledge of programming

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

O1: learn Matlab details

Course Outcome:

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

CO1 Apply MATLAB tools in designing programs.

CO2 Analyze different dimensions of a problem and provide optimal solutions.

CO3 Evaluate and analyze different solution in the domain of image processing and machine learning.

CO4 Get hands on practice of various machining processes which give a lot of confidence to manufacture prototypes in project works.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	2	-	1	2	1	2	2	-	-	1
CO2	2	-	-	-	-	2	-	2	2	1	2	2	-	-	1
CO3	2	-	-	-	-	2	-	1	2	2	2	1	-	-	2
CO4	1	-	-	-	1	3	-	3	2	2	2	1	2	-	3

Course Content:

Module I: Introduction to MATLAB
The MATLAB Environment, MATLAB Basics – Variables, Numbers, Operators, Expressions, Input and output. Vectors, Arrays – Matrices

Module II: MATLAB Functions
Built-in Functions, User defined Functions

Module III: Graphics with MATLAB
Files and File Management – Import/Export, Basic 2D, 3D plots , Graphic handling

Module IV: Programming with MATLAB
Conditional Statements, Loops • MATLAB Programs – Programming and Debugging. • Applications of MATLAB Programming.

Module V: Mathematical Computing with MATLAB
Algebraic equations, Basic Symbolic Calculus and Differential equations, Numerical Techniques and Transforms

Text books:

1. Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, (2006).

Reference books:

1. "Essentials of MATLAB Programming", 2nd Ed., Stephen J. Chapman, Cengage Learning, (2009).
2. "MATLAB Demystified", David McMahon, The McGraw-Hill Companies, (2007).

5th Semester

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT501	Database Management System	3	0	0	3	3
2	ENGG	Major	IT502	Computer Networking	3	0	0	3	3
3	ENGG	Major	IT503	Machine Learning	3	0	0	3	3
4	ENGG	Major	IT504	Full Stack Web Development	3	0	0	3	3
5	ENGG	Minor	IT501A	Operation Research & Optimization Technique	3	0	0	3	2
			IT501B	Ecommerce & ERP					
			IT501C	Compiler Design					
			IT501D	Distributed System					
6	HUM	Minor	HU(IT)501	Economics for Engineers	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	IT591	Database Management System Lab	0	0	3	3	1.5
2	ENGG	Major	IT592	Computer Networking Lab	0	0	3	3	1.5
3	ENGG	Major	IT593	Machine Learning Lab	0	0	3	3	1.5
4	ENGG	Major	IT594	Full Stack Web Development Lab	0	0	3	3	1.5
5	PRJ	Project	IT581	Project-1	0	0	3	3	1
Total of Theory, Practical								34	22

Course Name: **Database Management System**
Course Code: **IT501**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Prerequisites: Logic of programming language, Basic concepts of data structure and algorithms

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

O1: To develop conceptual understanding of database management system for solving different industry level problems & to learn its applications.

Course Outcome:

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

CO1 Understand Database Management System, explain fundamental elements of a database management system.

CO2 Compare the basic concepts of relational data model, entity-relationship model, file organization and use appropriate index structure.

CO3 Apply efficient query optimization techniques, suitable transaction management, concurrency control mechanism and recovery management techniques..

CO4 Analyze the database design techniques and improve the design by normalization.

CO5 Design entity-relationship diagrams to represent simple database application scenarios, translate entity-relationship diagrams into relational tables, populate a relational database and formulate SQL queries on the data.

CO-PO Mapping:

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

Course Contents:

Module I: [2L]
Introduction: Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module II: [9L]
Entity-Relationship and Relational Database Model
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 III: [6L]
SQL and Integrity Constraints
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 IV: [8L]
Relational Database Design
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 V: [7L]
Internals of RDBMS
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 VI: [6L]
File Organization & Index Structures
File & Record Concept, Placing file records on Disk, 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: **Computer Networking**
Course Code: **IT502**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Basic Digital Communication, Computer Architecture and Operating System.

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

O1: Understanding the basic concept of different network models, explaining the network architecture, analyzing and evaluating different network protocols.

Course Outcome:

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

CO1 Illustrate the network topologies, model and architecture.

CO2 Apply different networking device, protocol for problem solving

CO3 Analyze different networking functions in different layer of OSI and TCP/IP Model.

CO4 Evaluate the optimal route for communication and idea about routing algorithms for data transmission.

CO5 Design network architecture and implement in practical field of work.

CO-PO Mapping:

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

Course Contents:

Module I: [4L]

Overview of Data Communication and Networking: Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI and TCP/IP.

Module II: [5L]
Physical Layer: Overview of data, signal, transmission & transmission media; Circuit switching: time division & space division switch, TDM bus; Telephone Network.

Module III: [8L]
Data link Layer: Types of errors, framing, error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go Back- N ARQ, Selective repeat ARQ, HDLC; Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet.

Module IV: [7L]
Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing: techniques, Routing Protocols, ARP, IP, ICMP, IPV6.

Module V: [6L]
Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

Module VI: [6L]
Application Layer: DNS, SMTP, SNMP, FTP, HTTPS, Firewalls, IP Filtering.

Text books:

B. A. Forouzan – "Data Communications and Networking (5th Ed.) "– TMH.
W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education.

Reference books:

S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI.
Black, Data & Computer Communication, PHI.
Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP.

Course Name: **Machine Learning**
Course Code: **IT503**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Probability, Linear Algebra, Multivariable Calculus, Programming

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

O1: Get overview of many concepts, techniques, and algorithms in machine learning related to classification and regression problems.

O2: Get basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work.

Course Outcome:

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

CO1 Understand the basics of machine learning techniques that make it useful to real- world problems.

CO2 Apply machine learning algorithms such as supervised, semi-supervised, and

CO3 unsupervised.

CO4 Analyze various machine learning techniques to investigate real world applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	3	2	-	-	-	-	-	-	-	3	2	-	3
CO3	2	2	1	2	-	-	-	-	-	-	-	3	3	-	3
CO4	3	3	3	1	-	-	-	-	-	-	-	3	3	-	2

Course Contents:

Module I: [8L]
Basics of Linear Algebra Introduction to Machine Learning, linear classification, perceptron update rule, Perceptron convergence, generalization, Maximum margin classification, Classification errors, regularization

Module II: [9L]
Logistic regression Linear regression, estimator bias and variance, active learning, Active learning, non-linear predictions, Regression/Classification Basic methods: Distance-based methods, Nearest Neighbors, Decision Trees, Kernel regression, kernel optimization, Model selection criteria,

Description length, feature selection, expectation maximization.

Module III: [10L]
Classification problems; decision boundaries; nearest neighbor methods, Probability and classification, Naive Bayes, Bayes' Rule and Naive Bayes Model, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Logistic regression, online gradient descent, neural network, support vector machine (SVM), kernel SVM.

Module IV: [9L]
Ensemble methods Bagging, random forests, boosting, Unsupervised learning: clustering, k-means, hierarchical agglomeration, Advanced discussion on clustering, Latent space methods; PCA, Text representations; multinomial models; clustering and latent space models.

Text books:
1. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Reference books:
1. Simon Haykin, Neural Networks and Learning Machines Third Edition, Pearson Publisher.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer, 2006.
3. Pattern Classification. Richard Duda, Peter Hart and David Stock. Second Edition, Wiley Interscience.

Course Name: **Full Stack Web Development**
Course Code: **IT504**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Computer Networking, Database Management System, JAVA Programming Language.

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

O1: Describing the web application architecture and protocols, illustrating different technologies those are used to develop web applications, describing different frameworks those used to develop web applications.

Course Outcome:

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

CO1 Understand web application architecture, technologies and frameworks.

CO2 Apply the concept of different front end and back end components in problem solving

CO3 Analyze different architecture and web components

CO4 Evaluate different solutions in field of web application development

CO5 Design web application architecture to provide solution in web application development fields

CO-PO Mapping:

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

Course Contents:

Module I: [2L]
Introduction to World Wide Web: Web Architecture, Web Applications, Web servers, Web Browsers and Agents, Internet standards, DNS, SMTP, Pull and Push mechanism: Pros and Cons. HTTP, HTTPS, XMPP

Module II: [2L]
Mark-up: HTML: Elements, Attributes, Tags, Forms, Input, Frames, Tables

Module III: [2L]
Cascading Style Sheets:
Advantages, Rules, CSS, inline and external, using template Layouts

Module IV: [5L]
Java Script and Node JS: Basic java Script concepts, Use of Java Script, Variable, Object, function, Event Handling. Evaluation of Java Scrip. Create, Publish, Extend & Manage, Node.js HTTPs: Create Server and Get Data, Node.js Express, Node JS Mongo DB. Node.js Promise, Node.js Generators & Compare with Callbacks, Node js Streams: File stream, Pipes, Node.js Testing with Jasmine

Module V: [7L]
Server-side Programming: Servlets: HTTP Tunneling, Programmatically issuing HTTP GET, POST etc. and retrieval of content Concept of Dynamic Web pages, Web server versus Application server, Role of threading in a Server, Servlet-2.x API conforming to Web 2.0: Role of web.xml as deployment descriptor, request and response, Basic request handling, parameter retrieval, multiple parameter retrieval, inter-Servlet collaboration: Dispatching the request, Concept of state of web: Sessions , tracking session, Using Cookies and session Id, Parameter passing to and from session, Servlet Filters and common uses of Filters and Cookies. Migration to Servlet 3.x plus and omission of web.xml and concept of Web Socket.

Module VI: [6L]
Persistence: JDBC 3.x framework: Need and different approaches of persistence of data, connecting to databases using c, ODBC bridge and Type-4 drivers, executing basic CRUD using JDBC: Statement, Prepared Statement, Result Set. Execution of batch SQL, Stored Procedures using Callable Statement, Transaction Failure management: Save Point and roll back concepts, Prevention of SQL injection, Concept of connection URL in details: Connecting to a remote database host (server). Concept of roles of Drivers: Java reflection in Action.

Module VII: [6L]
Java Server Pages: Benefits of JSP over Servlets, JSP scriptlets, page directives, declarations, action tags: <jsp:useBeabn/>, <jsp:include/><jsp:forward/> ,
introduction to MVC and Spring MVC.

Module VIII: [2L]
XML Technologies: XML, Namespace, DTD, W3C XML Schema.

Module IX: [2L]
Ajax: Introduction to Asynchronous pattern and Using XML to communicate over XML Http Request object. Handling 5 states and finding response state.
Migration of Ajax to AJAJ.

Module X: [2L]
Web Service Introduction to web service architecture. Simple object access protocol, Web service description language, RESTful web service.

Text books:
1. Professional Java Server Programming Allamaraju, Apress

Reference books:
1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions INC.

Course Name: **Operation Research and Optimization Technique**
Course Code: **IT501A**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: The students must have basic Knowledge of Function, plotting of Equation and in equations,
Formulation of Mathematical Problem. Finding maximum and minimum from row or column or from Matrix.

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

O1: Develop models and then analyze the model using the techniques of Operations Research, Decision making under uncertainty and risk.

Course Outcome:

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

CO1 Understand knowledge-base representation models.

CO2 Apply different rule-based expert systems and planning tools.

CO3 Analyze the performance of rule-based-systems.

CO4 Develop heuristic search algorithms for real life problem solving.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	2	1	-	-	-	-	-	-	-	2	2	-	2
CO3	2	3	3	2	-	-	-	-	-	-	-	2	3	-	2
CO4	2	3	3	3	-	-	-	-	-	-	-	2	3	-	3

Course Contents:

Module I: [10L]
Linear Programming Problem (LPP): Basics of Linear Programming Problem(LPP) and its Applications. General Mathematical Formulation of LPP; Definitions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module II: [6L]
Transportation Problem, Assignment Problem.

Module III: [5L]
Game Theory: Introduction; Two person Zero Sum game, Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module IV: [5L]
Distributed Consensus, Nakamoto consensus, Proof of Work (PoW), Proof of Stake (PoS), Proof of Burn (PoB), Delegated Proof of Stake (DPoS), Byzantine Fault Tolerance (BFT), Practical Byzantine Fault Tolerance (PBFT), Ripple Protocol Consensus Algorithm (RPCA), Difficulty Level, Sybil Attack, Energy utilization and alternate.

Module V: [2L]
Sequencing: Johnson's Algorithm (1957) For n Jobs and two machines, Jobs and three machines.

Module VI: [5L]
Queuing Theory: Introduction and Basic Structure of Queuing Theory; Basic Definitions and
Notations; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1): (∞/FIFO) and (M/M/1):(N/FIFO) and Problems.

Module VII: [3L]
Inventory Control: Determination of EOQ, Components, Deterministic Continuous & Deterministic Periodic Review Models, Stochastic Continuous & Stochastic Periodic Review Models.

Textbooks:

1. Operations Research by Kanti Swaroop and P.K. Man Mohan, Sultan Chand and Sons
2. Linear Programming and Theory of Games by Ghosh and Chakraborty, Central Book Agency

Reference books:

1. Linear Programming and Theory of Games by P.M.Karak, ABS Publishing House
2. Operations Research, D.K.Jana & T.K.Roy, Chhaya Prakashani Pvt. Ltd.
3. Operations Research, Kalavati,VIKAS
4. Operations Research, Humdy A Taha, PHI / Pearson
5. Operations Research Theory and Applications by J.K.Sharma, Macmillan India Limited.

Course Name: **E Commerce & ERP**
Course Code: **IT501B**
Contact: (3:0:0)
Total Contact Hours:36
Credit: 3

Pre requisites: Concepts of Computer Networking, Operating System, Database Management System

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

O1: explain the characteristics and functions of electronic commerce including mobile commerce, fundamental characteristics of electronic markets, common business models used in B2C and B2B electronic commerce.

O2: acquire an overview to ERP and the knowledge on related technologies. Skill to ERP Manufacturing Perspective and ERP modules

O3: examine ERP tools and understand the benefits of ERP.

Course Outcome:

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

CO1 Understand the policy issues related to privacy, intellectual property rights, and establishing identity those are germane to electronic commerce along with the Internet and related technologies.

CO2 Comprehend the underlying economic mechanisms and driving forces of E-Commerce.

CO3 Analyse the impact that electronic commerce is facing and outlines the different digital transaction process and basic concepts of e-commerce.

CO4 Identify different technologies and IT support used in ERP.

CO5 Apply different tools used in ERP.

CO-PO Mapping:

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

Course Contents:

Module I: [5L]
Introduction to E-Commerce:
Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Interchange and Internet Commerce**.**

Module II: [6L]
Business to Business E-Commerce:
Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E- commerce. Business models for E-commerce, Business Process Re-Engineering.

Module III: [5L]
Legal issues:
Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Module IV: [7L]
Security Issues:
Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security, Search engines, Intelligent agents in E-Commerce Electronic payment systems, E-security

Module V: [7L]
Business to Consumer E-Commerce and E-Business:
Consumer trade transaction, Web metrics, Elements of E-Commerce, Industry impacts of E-business. Integrating Intranet and internet web applications across multiple networks. Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Module VI: [5L]
Mobile Commerce:
Overview, Infrastructure, Applications, Mobile Payment, Limitations, Security in M-Commerce, ERP and Data warehousing, ERP and E-business.

Textbooks:

1.E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
2.Handbook on Electronic Commerce, Shaw et al., Springer publication.
3.Enterprise Resource Planning –Alexis Leon, Tata McGraw Hill

Reference books:

1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH.
2. Applied E-Commerce, Langer, John Wiley Publication.
3. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH.
4. Enterprise Resource Planning, 2nd Edition by Alexis Leon, Tata McGraw Hill Education, 2008.
5. Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGraw Hill, 1997.

Course Name: **Compiler Design**
Course Code: **IT501C**
Contact: (3:0:0)
Total Contact Hours:36
Credit: 3

Pre requisites: Mathematics, Computer Programming, and Automata basic concept.

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

Course Outcome:

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

CO1 Understand the knowledge of parsing, lexical and syntax analysis.

CO2 Apply the knowledge about the compilers they practically use.

CO3 Analyze various parsing techniques, code optimization.

CO4 Evaluate the process of parse trees are generation, errors are handling and code optimization

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3	3	-	-	-	-	-	-	2	2	2	-
CO2	3	1	2	2	-	-	-	-	-	-	-	1	2	2	-
CO3	3	1	2	2	2	-	-	-	-	-	-	2	3	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	1	3	1	-

Course Contents:
Module I: [3L]
Introduction to Compilers
Compilers and translators need of translators, structure of compiler: Phases of compilation and overview, Compiler construction tools

Module II: [5L]
Lexical Analysis (scanner)
Role of lexical analyzer, design of lexical analyzer, regular expressions, Specification and recognition of tokens, input buffering A language specifying lexical analyzer. Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer, scanner generator (lex, flex).

Module III: [9L]
Syntax Analysis (Parser)
Role of parsers, definition of parsing, Shift- reduce parsing, operator precedence parsing, predictive parsing. Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator, Canonical LR parser.

Module IV: [4L]
Semantic Analysis
Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree**.**

Module V: [6L]
Symbol Table
Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.

Module VI: [5L]
Intermediate Code Generation
Translation of different language features, different types of intermediate forms. Syntax directed definition, construction of syntax trees, syntax directed translation scheme, and implementation of syntax directed translation, three address code, quadruples and triples.

Module VI: [4L]
Code optimization and target code generation
Code improvement local optimization, global optimization, loop optimization, peep-hole optimization.

Text Books

1. Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D. Ullman; Addison Wesley.
2. Compiler Design by O.G. Kakde, Laxmi Publ.

Reference Books

1. Theory and practice of compiler writing, Tremblay & Sorenson, Mc. Graw Hill.
2. System software by Dhamdae, MGH.
3. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier

Course Name: **Distributed System**
Course Code:**IT501D**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Have to knowledge about Computer Network, operating system and Computer architecture. Required C and UNIX knowledge

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

O1: develop decision making skills using basic economic Principles, to educate the students in evaluating various Business Projects.

Course Outcome:

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

CO1 To define the distributed operating system, architecture, goal of DOS and its designing issues

CO2 To categorize the technique of inter-process communication

CO3 To choose the local clock instead of global clock and the different mutual exclusion and deadlock algorithms.

CO4 To organize the distributed file system and shared memory architecture.

CO5 To evaluate the idea about the designing policy of different distributed operating system like AMOEBA, MACH, DCE.

CO-PO Mapping:

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

Course Contents:

Module I: [6L]
Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture.

Module II: [6L]
The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.

Module III:[8L]
Clocks: Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamppost's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms-Bully algo etc., Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.

Module IV: [8L]
Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.

Module V: [8L]
File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, , Amazon AWS, OpenStack, Cilk, gdb, threads, OpenMP, Hadoop), Case studies.

Textbooks:

1. P.K. Sinha Distributed Operating system (Willey publication)
2. M. Beck et al Linux Kernel, Internal Addition Wesley,1997.

Reference books:

1. T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN0-8186-3032-9
2. R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, AddisonWesley (1997) ISBN0-201-49838-3
3. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN0-201-61918-0
4. D. L. Galli, Distributed Operating Systems, Prentice-Hall (2000) ISBN0-13-079843-6

Course Name: **Economics for Engineers**
Course Code: **HU(IT)501**
Contact: (2:0:0)
Total Contact Hours: 24
Credit: 1

Pre requisites:

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

O1: acquaint with the basic principles of economics
O2: develop decision making skills using basic economic Principles,
O3: evaluating various Business Projects.
.

Course Outcome:

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

CO1	Apply the appropriate engineering economics analysis method for problem solving
CO2	Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.
CO3	Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and systems.
CO4	Evaluate the profit of a firm, carry out the break even analysis and employ the tool to make production decision.
CO5	Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

CO-PO Mapping:

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

Course Contents:

Module I: [2L]

Introduction to Economics:

Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and Scope of Economics, Managerial Decision Analysis

Module II: [**4L**]

Demand-Supply Framework & Equilibrium:

Demand and Supply: Determinants of demand, movements vs. shift in demand curve, Determinants of Supply, Movement along a supply curve vs. shift in supply curve; Market equilibrium and price determination. Elasticity of demand and supply, Application of demand and supply. Consumer Theory: Ordinal Utility theory: (Indifference curve approach): Consumer's preferences; Indifference curves; Budget line; Consumer's equilibrium.

Module III: [6L]

Theory of Production and Costs:

concept of Production function, types of Production function, Laws of return to scale and variable Proportion, Cost Function, Types of Cost Function, Different Cost curves, Relation between Average and marginal cost, Relationship between Short Run costs and Long Run costs, Cost volume profit analysis and it's application

Module IV: [4L]

Selected Macroeconomic Principles:

Introduction to Macroeconomic Variables – Circular Flow of Income – Closed and Open Economy Models - Saving-Investment Identity.

National income and different technique to measure of national income

inflation: Inflation – Causes, Measurement, Effect, Measures to Control Inflation.

Module V: [5L]

Financial Accounting and Financial management:

Accounting Basic concept of Journal, Trading A/C, Profit& Loss A/C, Balance Sheet and the concept of time value of money(application of all factors of time value of money) & Capital budgeting technique.

Module VI: [3L] Market Structure:

Classification of Different Markets (Concepts only) – Perfect Competition, Monopoly, Monopolistic Competition, Monopsony and Oligopoly.

Perfect Competition: Assumption; Theory of a firm under perfect competition; Demand and Revenue; Equilibrium of the firm in the short run and long run.

Monopoly: Short-run and long-run equilibrium of monopoly firm; Price discrimination.

Text books:

1. Economics, by Lipsey and Chrystal, Oxford university Press
2. Modern Accountancy, Vol.-I-, by Hanif &Mukherjee, Tata Mgrow Hill

Reference books:

1. Modern Economic Theory, by K.K. Dewett, S.Chand Principles of Economics, by H.L. Ahuja, S. Chand
2. Engineering Economics, by R. Paneer Seelvan, PHI
3. Economics for Engineers, by Dr. Shantanu Chakraborty & Dr. Niranjana Singha Roy, Law Point Publicatio

Course Name: **Database Management System Lab**
Course Code: **IT591**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites: Knowledge about the basics of electronics and basic concepts in logic design, basic knowledge of data structure and programming concept.

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

O1: develop conceptual understanding of database management system for solving different industry level problems & to learn its applications.

Course Outcome:

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

CO1 Applying SQL and PL/SQL for processing database

CO2 Analyze the database using queries to retrieve records

CO3 Develop solutions using database concepts for real time requirements.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	-	-	-	-	-	-	2	2	-	2
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	-	2
CO3	3	3	3	3	3	-	-	-	2	-	-	3	3	-	3

Course Contents:

1. Study of Backend Tool – Oracle.
2. Data Definition Language (DDL) commands in RDBMS.
3. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.
4. High-level language extension with Cursors.
5. High level language extension with Triggers
6. Procedures and Functions.
7. Embedded SQL.
8. Database design using E-R model and Normalization.
9. Mini project (Application Development using Oracle and Visual Basic)
    i. Inventory Control System.
    ii. Material Requirement Processing

iii. Hospital Management System
iv. Railway Reservation System
v. Personal Information System
vi. Web Based User Identification System
vii.Time-table Management System

Text books:

1. ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition

Reference books:

1. ORACLE DATA BASE LOG PL/SQL Programming SCOTT URMAN, Tata Mc- Graw Hill.
2. SQL & PL/SQL for Oracle 10g, Black Book, Dr.P.S. Deshpande.

Course Name: **Computer Networking Lab**
Course Code: **IT592**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites: Basic Operating System.

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

O1: Understand the basic concept of different network models, explaining the network architecture, apply different computer routing algorithms in real life problems.

Course Outcome:

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

CO1 Apply the concept of networking for implementing the solution

CO2 Analyze different networking protocols for optimal solution

CO3 Designing various network related applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	-	-	-	-	-	-	2	2	-	2
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	-	2
CO3	3	3	3	3	3	-	-	-	2	-	-	3	3	-	3

Course Contents:

1. Familiarization with: Different networking cables, Different connectors, Hubs, Switches, Routers.
2. NIC Installation & Configuration (Windows/Linux).
3. Understanding IP address, subnet etc, Connect the computers in Local Area Network.
4. Study of basic Network Configuration commands.
5. Configure a Network topology using packet tracer software.
6. Link Layer Error Detection Mechanism (Cyclic Redundancy Check), Data Link Layer Error Control mechanism (Selective Repeat, Go Back N).

7. Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window), Data 8. Server Setup/Configuration: FTP, TELNET, NFS, DNS, Firewall.
9. TCP/UDP Socket Programming: Simple, TCP based, UDP based Multicast & Broadcast Sockets.
10. CISCO Packet Tracer Example.

Text books:

1. A. Forouzan – "Data Communications and Networking (5th Ed.) "– TMH.
2. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education.

Reference books:

1. A.S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI.
2. Black, Data & Computer Communication, PHI.
3. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP.

Course Name: **Machine Learning Lab**
Course Code: **IT592**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites: Probability, Linear Algebra, Calculus, R/Python Programming

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

O1: Install and use R/Python for simple programming tasks, extended R/Python libraries and packages.

. Course Outcome:

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

CO1	Apply the concept of R programming language for machine learning algorithms such as supervised, semi-supervised, and unsupervised.
CO2	Analyze various machine learning techniques using R programming language to investigate real world applications
CO3	Evaluate and create model for finding the solution of real world industry issues

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1	2	-	-	-	2	-	-	3	3	-	2
CO2	2	3	2	2	3	-	-	-	-	-	-	3	3	-	2
CO3	3	3	2	2	3	-	-	-	2	-	-	3	3	-	2

Course Contents:

1. Write R/Python program to calculate the square root of 2345, and perform a log2 transformation on the result.
2. Print the 1 to10 numbers in reverse order in R/Python Programming language.
3. Find 10 random numbers between 0 and100 in R/Python Programming language.
4. Compute the truth table for logical AND in R/Python Programming language.
5. Use R/Python to find all the numbers between 1 and n which are multiples of some m.
6. Write a program in R/Python to check the leap year or not.
7. Find the Factorial of a given Number in R/Python.
8. Program to check whether the given number is Prime or not in R/Python.

9. Check whether the given number is Arm strong number or not.
10. Program to display multiplication table in R.

11. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
12. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

13. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
14. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this

Text books:

1. The Art of R Programming, Norman Matloff, Cengage Learning.
2. R for Everyone, Lander, Pearson.

Course Name: **Full Stack Web Development Lab**
Course Code: **IT592**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites: Basic knowledge on Java and computer networking and database.

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

O1: Describe the web application architecture and protocols; Illustrating different technologies those are used to develop web applications;
O2: Describe different frameworks those used to develop web applications.

. **Course Outcome:**

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

CO1 Apply the concept of web technology in designing solution

CO2 Analyze different features of web technology for best sutiable solution providing

CO3 Evaluate different web application solution applying the concept of different front end and back end technologies

CO4 Create web application solution for different problems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	3	-	-	-	-	-	-	3	2	-	3
CO2	2	3	2	3	3	-	-	-	-	-	-	3	3	-	1
CO3	2	2	2	3	3	-	-	-	-	-	-	3	3	-	2
CO4	3	3	3	-	3	-	-	-	2	-	-	-	3	-	3

Course Contents:

HTML Developing application using different HTML elements, designing forms using HTML, Apply DOM CSS Using different CSS Styles for designing interactive forms and interfaces. Java Script Using Java script variables, operators, control structure, functions and event handling, Form validation using java script, Node js server implementation, express js for implementing web application handling get, put, post, etc.

JDBC Connecting to databases using jdbc:odbc bridge and Type-4 drivers, Batch execution, Stored Procedure Servlet Developing web application using servlet: get/post, Developing filter application, Session handling. JSP Developing web application using JSP as view, Session handling using JSP, Using JSP components, Custom tag development.

AJAX Developing web application using AJAX: accessing XML, text files. Web Service Development web service as reusable components Innovative Experiments. Develop some innovative experiments.

Text books:

1. Professional Java Server Programming Allamaraju.

Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. A kilandeswari, PHI Learning, Delhi, 2013.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions INC.

6th Semester

A. THEORY									
1	ENGG	Major	IT601	Cloud Computing	3	0	0	3	3
2	ENGG	Major	IT602	Internet of Things	3	0	0	3	3
3	ENGG	Major	IT603	Cryptography and Network Security	3	0	0	3	3
4	ENGG	Major	IT604	Data Warehousing and Data Mining	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(IT)601	Project Management and Finance	2	0	0	2	2
6	ENGG	Minor	IT605A	Digital Image Processing	3	0	0	3	2
			IT605B	Mobile Communication					
			IT605C	Internet Technology					
			IT605D	Computer Graphics and Multimedia					
B. PRACTICAL									
1	ENGG	Major	IT691	Cloud Computing Lab	0	0	3	3	1
2	ENGG	Major	IT692	Internet of Things Lab	0	0	3	3	1
3	ENGG	Major	IT693	Cryptography and Network Security Lab	0	0	3	3	1
4	ENGG	Internship	IT681	Industrial Training and Project (Duration: 1 months)	0	0	0	0	2
Total of Theory, Practical								30	21

Course Name: **Cloud Computing**
Course Code: **IT601**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Networking, Operating System, Web Technology.

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

O1: learn and understand Cloud computing in details and identify the usage of it.

Course Outcome:

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

CO1 Understand the basic architecture of cloud computing

CO2 Apply the knowledge of cloud computing in the evaluation of the computing model.

CO3 Analyze different features of Cloud Computing

CO4 Evaluate the different models and solutions provided in the field of cloud computing.

CO5 Design different solution with different services in cloud computing

CO-PO Mapping:

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

Course Contents:

Module I: Overview of Computing Paradigm [3L]

Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing.

Module II: Introduction to Cloud Computing [3L]
Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics and Disadvantages Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing

Module III: Cloud Computing Architecture and Services [3L]
Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) Infrastructure as a Service (IaaS) Platform as a Service (PaaS) Software as a Service (SaaS) Deployment Models Public Cloud Private Cloud Hybrid cloud Community cloud.

Module IV: Virtualization [6L]
Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM) Resource Virtualization Server, Basics of VMWare, advantages of VMware virtualization, -understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module V: Cloud Storage Management [2L]
Storage as a service, Data storage in cloud computing (storage as a service)

Module VI: Service Oriented Architecture [5L]
Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP. Message exchange patterns- Service activity coordination-atomic transactions- Business Activities-Orchestration-Choreography, Service-Oriented Design Introduction to service- oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. WS-BPEL language basics WS Coordination

Module VII: Service Management in Cloud Computing [5L]
Service Level Agreements (SLAs) Billing and Accounting Comparing Scaling Hardware: Traditional. Cloud Economics of Scaling: Benefitting enormously Managing Data Looking at Data, Scalability and Cloud Services Database and Data Stores in Cloud Large Scale Data Processing.

Module VIII: Cloud Security [6L]
Infrastructure Security Network level security, Host level security, Application-level security Data security, Identity and Access Management Access Control Trust, Reputation, Risk Authentication in cloud computing

Module IX: Case Study on Open Source and Commercial Clouds [3L]
Google Cloud, Microsoft Azure, Amazon EC2

Textbooks:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

Reference books:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
2. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee, Gillam, Springer, 2012
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Course Name: **Internet of Things**
Course Code: **IT602**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Operating System, Wireless Sensor Networks, Computer Networks, Cryptography, Communication Technology, Python Programming Language, and Cloud computing.

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

O1: to learn and understand Internet of Things (IoT) in detail and identifies the application potentials of this technology.

. **Course Outcome:**

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

CO1 Understand the basic concepts of IoT and its architectures

CO2 Apply the concepts of IoT to design different smart tools

CO3 Analyze different issues in the domain of IoT and understand the practical applications of IoT

CO4 Evaluate and analyze different solution for the real life problems of IoT

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	3	2	-	1
CO3	1	3	2	3	-	-	-	-	-	-	-	2	3	-	3
CO4	3	3	1	2	-	-	-	-	-	-	-	2	3	-	3

Course Contents:

Module I:Wireless Sensor Network [4L]:
Network and Communication aspects, Wireless medium access issues, MAC protocol, Routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination, Topology, Connectivity, Single-hop and Multi-hop communications.

Module II:Fundamental of IoT [4L]:
The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet,

Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

Module III:IoT and M2M [5L]:
Main design principles and needed capabilities, IoT architecture outline, standards, M2M and IoT Technology Fundamentals, Devices and gateways, Local and wide area networking, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT
Architectural Overview, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module IV:IoT Architecture [6L]:
Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module V:IoT Privacy, Security and Governance [7L]:
Introduction, Overview of Governance, Privacy and Security Issues, Access Control, Authentication and Authorization, Distributed trust in IoT, Secure Platform design, Smart Approach. Data Aggregation for the IoT in smart cities, Intrusion detection and prevention, Security attacks and functional threats.

Module VI : IoT Layers Architecture [6L]:
PHY/MAC Layer - 3GPP MTC, IEEE 802.11, IEEE 802.15, Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7; Network Layer - IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP; Transport Layer - TCP, MPTCP, UDP, DCCP, SCTP TLS, DTLS; Session Layer - HTTP, CoAP, XMPP, AMQP, MQTT; Service Layer - oneM2M, ETSI M2M, OMA, BBF.

Module VII: IoT Applications for Value Creations [4L]:
Introduction, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Big Data and Serialization, IoT for Retailing Industry, Oil and Gas Industry, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and Internet technologies, Remote control operation of energy consuming devices.

Text Books:

1. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education; First edition.
2. Internet of Things fundamentals, David, Pearson Education.
3. Internet of Things by Tripathy and Anuradha, CRC Press.

Reference Books:

1. Getting Started with The Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Cuno Pfister O'Reilly
2. Internet of Things (A Hands-On-Approach), Vijay Madisetti and ArshdeepBahga, Orient Blackswan Private Limited - New Delhi; First edition.

Course Name: **Cryptography and Network Security**
Course Code: **IT603**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Mathematics, Computer Networking,

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

O1: study the about how to maintain the Confidentiality, Integrity and Availability and Authenticity of the data over insecure channel by various means
O2: understand various protocols for network security to protect against the threats in the networks.

Course Outcome:

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

CO1 Identify computer and network security threats, classify the threats, and understand different technique of cryptography and security.

CO2 Apply different algorithm and technique of encryption and decryption method over information and security techniques to the existing computer and network

CO3 platforms.

CO4 Analyze existing cryptographic algorithm, authentication, and key agreement

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	-	-	-	2	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	-	1
CO3	3	1	2	-	-	-	-	2	-	-	-	2	3	-	3
CO4	3	2	2	2	-	-	-	-	-	-	-	2	3	-	3

Course Contents:

Module I: [5L]
Introduction: Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

Module II: [7L]
Cryptography: Concepts & Techniques Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, and Symmetric & Asymmetric key Cryptography, Key Range & Key Size

Module III: [8L]
Symmetric Key Cryptography: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

Module IV: [6L]
Public Key Cryptography: Overview of Asymmetric key Cryptography, Digital Signature and RSA Introduction, RSA algorithm, PKCS (Public Key Cryptography Standard), Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function

Module V: [6L]
Internet Security: Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module VI: [4L]
Security Practice: Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME.

ModuleVII: [3L]
System Security: Firewall Introduction, Types of firewall, Firewall Configurations

Text Books:

1. Cryptography and Network Security, William Stallings, 2nd Edition, Pearson Education Asia
2. Network Security private communication in a public world, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.

Reference Books:

1. Network Security Essentials: Applications and Standards by William Stallings, Pearson
2. Designing Network Security, Merike Kaeo, 2nd Edition, Pearson Books
3. Building Internet Firewalls, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition
4. Cryptography: theory and practice by Douglas R. Stinson Chapman and Hall/CRC.

Course Name: **Data Warehousing and Data Mining**
Course Code: **IT604**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Database Management System, Mathematics.

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

O1: familiar with the concepts of data warehouse and data mining and be acquainted with the tools and techniques used for knowledge discovery in databases.

. **Course Outcome:**

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

CO1 Understand the basic concepts of data warehousing and data mining.

CO2 Apply the various mining algorithms for extract knowledge from data warehouse

CO3 Analyze different data warehousing methodologies and data mining algorithms

CO4 Design a data warehouse

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	-	-	-	-	-	-	-	-	2	-	-	1
CO2	3	2	3	1	-	-	-	-	-	-	-	2	2	-	2
CO3	3	2	2	2	-	-	-	-	-	-	-	2	3	-	2
CO4	3	2	3	2	-	-	-	-	-	-	-	2	3	-	3

Course Contents:

Module I: [7L]

Data Warehouse:

Data Warehousing Components, Building A Data Warehouse, Mapping the Data Warehouse to A Multiprocessor Architecture, DBMS Schemas For Decision Support, Data Extraction, Cleanup, And Transformation Tools, Metadata

Module II: [7L]

Business Analysis:

Reporting And Query Tools and Applications, Tool Categories, The Need For Applications, Cognos Impromptu, Online Analytical Processing (OLAP), Need, Multidimensional Data Model, OLAP Guidelines, Multidimensional Versus Multi-relational OLAP, Categories of Tools, OLAP Tools And The Internet

Module III: [7L]

Data Mining:

Introduction, Data Types, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Data Warehouse, Issues, Data Pre-processing.

Module IV: [7L]

Association Rule Mining and Classification:

Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining Various Kinds Of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification And Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification By Back Propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

Module V: [7L]

Clustering and Trends in Data Mining:

Cluster Analysis, Types of Data, Categorization of Major Clustering Methods, K-Means, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint, Based Cluster Analysis, Outlier Analysis, Data Mining Applications.

Text books:

1. Alex Berson And Stephen J. Smith, “Data Warehousing, Data Mining And OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han And Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

Reference books:

1. Data Mining, Practical Machine Learning Tools and Techniques, Third Edition; Ian H.
2. Witten, Eibe Frank, Mark A. Hall
3. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and
4. Stephen J. Smith, TataMcGraw Hill Education
5. Data warehouse Toolkit by Ralph Kimball, Wiley India
6. Data Warehousing in the real world; Anahory; Pearson Education.

Course Name: **Project Management and Finance**
Course Code: **HU(IT)601**
Contact: (2:0:0)
Total Contact Hours: 36
Credit: 2

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.

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: **Digital Image Processing**
Course Code: **IT605A**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 2

Pre requisites: Knowledge on Computer Programming.

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

O1: gain overview about the available techniques and possibilities of this field.
O2: learn basic image transformation, segmentation algorithms and problems of object measurements.

Course Outcome:

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

CO1 Understand the fundamental concepts of a digital image processing system

CO2 Apply various transformation techniques for improving the image quality

CO3 Analyze various image compression techniques.

CO4 Evaluate image segmentation and representation techniques

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	1
CO2	3	2	2	1	-	-	-	-	-	-	-	2	2	-	1
CO3	2	3	2	1	-	-	-	-	-	-	-	2	2	-	1
CO4	3	2	2	1	-	-	-	-	-	-	-	2	2	-	1

Course Contents:

Module I: [3L]

Introduction to Digital Image Processing: Elements of digital image processing systems, Elements of visual perception Brightness, contrast, hue, saturation, match band effect, Image sampling and quantization.

Module II: [8L]
Image Enhancement: Spatial Basic grey level transformation, Histogram equalization, Histogram specification techniques, Noise Distributions, Image subtraction and Image averaging, Smoothing, sharpening filters, Frequency Domain methods: Introduction to Fourier Transform and DFT, Discrete Cosine Transform (DCT) and its properties, Smoothing in Frequency- Domain, Sharpening in Frequency- Domain, Homomorphic filtering.

Module III: [5L]
Image Restoration: Model of Image Degradation/restoration process, Noise models, Unconstrained restoration, Lagrange multiplier, least mean square filtering, Constrained least mean square filtering, Wiener filtering.
,Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint, Based Cluster Analysis, Outlier Analysis, Data Mining Applications.

Module IV: [3L]
Color Image Processing: Different color Models, Color Transformations, Smoothing & Sharpening Color Image, Color Segmentation, Noise.

Module V: [6L]
Image Compression: Need for data compression, Different types of compression, Variable length coding-Huffman Coding, Run Length Encoding, Arithmetic coding, Lossy Compression: Vector Quantization, Transform coding, Basics of Image compression standards: JPEG.

Module VII: [3L]
Image registration: Geometric transformations: translation, rotation, scaling, homomorphic coordinate system; ground control points, affine transformation.

Module VIII: [2L]
Representation & Description: Representation of segmented image, Boundary & Regional Descriptors, Use of Principal components for description.

Text books:

1. Digital Image Processing by Woods, Gonzalves, Pearson.
2. Digital Image Processing & Analysis by Chanda & Majumder, PHI.

Reference books:

1. Digital Image Processing by Jahne by Springer India.
2. Image Processing, Analysis & Machine Vision by Sonka, VIKAS.
3. Fundamentals of Digital Image Processing by Jain, PHI.

Course Name: **Mobile Communication**
Course Code: **IT605B**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 2

Pre requisites: Principles of mobile computing, Basic concepts of network protocol.

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

O1: learn about the concepts and principles of mobile computing,
O2: explore both theoretical and practical issues of mobile computing
O3: develop skills of finding solutions and building software for mobile computing applications.

Course Outcome:

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

CO1	Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing.
CO2	The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
CO3	Understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
CO4	Able to promote the awareness of the life-long learning, business ethics, professional ethics and current marketing scenarios.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	3	2	-	-	-	-	-	-	-	3	-	-	-
CO3	2	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	3	3	2	-

Course Contents:

Module I: [2L]

Short history of wireless communication, Applications, Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread Spectrum, Cellular systems (DSSS & FHSS). Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.

Module II:[9L]
PCS Architecture, Cellular Telephony: Advanced Mobile Phone Service(AMPS); Global System for Mobile Communication (GSM); EIA/TIA IS-136 Digital Cellular System; EIA/TIA IS-95 Digital Cellular System, Cordless Telephony and Low-Tier PCS: Cordless Telephone, Second Generation (CT2); Digital European Cordless Telephone (DECT); UMTS, Personal Handy Phone System (PHS); Personal Access

Communications System (PACS) ; Unlicensed Systems, 3G Wireless systems. Mobility Management: Handoff (Inter-BS, Intersystem), Roaming Management, Handoff Management - Detection and Assignment: Strategies for Handoff Detection, Channel Assignment, Handoff Management – Radio Link Transfer: Hard and Soft Handoff, Network Signaling : Signaling System No.7, Interconnection and Message Routing, Mobility Management.

Module III: [6L]
GSM: Mobile services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New data services, GSM Short Message Service, VOIP service for Mobile Networks : GSM on the Net, The iGSM Wireless VoIP Solution, The H.323 Network, iGSM Architecture, iGSM Procedures and Message Flows: Registration, Deregistration, Call Delivery to the IP Network: Implementation Issues; International Roaming for GSM, GSM Operations, Administration, & Maintenance, Mobile Number Portability. GPRS: Functional Groups, GPRS Architecture, GPRS Network Nodes:18.3.1 Mobile Station; Base Station System; GPRS Support Node; HLR and VLR, GPRS Interfaces: Um Interface; EDGE;Gb Interface; Gn and Gp Interfaces; Gs Interface; Gi Interface, GPRS Procedures.

Module IV: [8L]
Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium Access Control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control sublayer, Medium Access Control sublayer, Information bases and Networking. Bluetooth: User Scenarios, Physical Layer, MAC layer, Networking. Security, link management, Enterprise PCS: Office Level , Local Area Wireless: An Example of WPBX, Capacity Planning for WPBX, IrDA ZigBee, RFID, Wireless Broadband (WiMax)

Module V: [7L]

Support for Mobility: Mobile Computing Architecture: Three Tier Architecture for mobile computing, Design considerations, Mobile Computing through Internet. File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Mobile File System, Mobile databases. Language Support: Hypertext markup language (XHTML)-MP, Wireless markup language; WML script,Mobile Application Languages-XML, Voice XML. Java, J2ME and JavaCard. Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, WAP UAProf and Caching , User Agent Profile , Caching Model , Wireless Bearers for WAP
, WAP Developer Toolkits and application environment, Wireless telephony application, Mobile agents, Application Server, Gateways, Portals, Service Discovery, Device Management Wireless devices and their Operating System : PalmOS; Windows CE; EPOC; Symbian OS; Linux for Mobile Devices. Mobile Agents Threats and Security Issues in Mobile Computing

Text books:

1. Jochen Schiller, "Mobile communications", Addison wisely, Pearson Education
2. Wireless and Mobile Network Architecture: Yi Bang Lin and ImrichChlamtech (Wiley).
3. Mobile Computing by RajKamal (Oxford).

Reference books:

1. Rappaort, "Wireless Communications Principals and Practices'
2. YI Bing Lin, "Wireless and Mobile Network Architectures', John Wiley
3. P. Nicopolitidis, "Wireless Networks', John Wiley
4. K. Pahlavan, P. Krishnamurthy, "Principles of Wireless Networks"

Course Name: **Internet Technology**
Course Code: **IT605C**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 2

Pre requisites: Computer Networking, Web Technology.

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

O1: Understanding the architecture of enterprise application and developing enterprise applications.

Course Outcome:

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

CO1	Understand advanced networking concepts and internet and web application architectures
CO2	Apply and Analyze d different advanced routing protocols being used in web application development
CO3	Evaluate and analyze different solution available in the field of networking and web application development such as http and the World Wide Web, HTML, and Java Scripts;
CO4	Implement solution for different critical network related issues as; implementing the design using the client/server model, testing, and documenting the solutions developed.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	-	2

Course Contents:

Module 1: An Overview on Internet [2L]

Properties of the Internet, Internet Architecture, Interconnection through IP Gateways or routers, Internet and Intranet.

Module 2: Internet Address: [6L]

Introduction, Universal identifiers, three primary classes of IP addresses, Classless IP address, Network and Broadcast addresses, Mapping internet addresses to physical addresses (ARP), ARP protocol format, Transport Gateways and subnet addressing, Multicast addressing. IPV6, Conversion from IPV4 to IPV6

Module 3: Internet Protocol: [4L]
The Internet Datagram, Routing direct and indirect delivery, Table driven IP routing, Protocol layering, Reliable stream transport, TCP performance, Bootstrap protocol (BOOTP).

Module 4: Routing: [4L]
The origin of Gateway routing tables, Original Internet Architecture and Cores, Core Gateways, Automatic route propagation, Vector distance (Bellman-Ford), routing, Gateway to Gateway Protocol (GGP), Autonomous system concept, Exterior Gateway Protocol

(EGP), Interior Gateway Protocol (RIP, OSPF, HELLO), Routing Information Protocol (RIP), Combining RIP, HELLO, and EGP, Routing with partial information.

Module 5: Internet Servers: [4L]
DNS, DHCP Servers, FTP, TELNET, E-Mail

Module 6: Firewall & Networking [6L]
Introduction, Implementation of Firewall, Activities of Firewall, Configuration of firewall, Firewalls & SSL, SSL implementation, Bit implementation of SSL, Use of SSL.

Module 7: ASP .NET: [10L]
Architecture and Component, Page life cycle, Control: Check Box, Radio Button, List, Label. Session Management, Web Form Handling, Accessing database, Hosting of Web application.

Textbooks:

1. Computer Networks and Internets - Douglas E. Comer; PE.

Reference books:

1. Communication Networks - Leon-Garcia-Widjaja; TMH.
2. Internetworking with TCP / IP - Douglas E .Comer; PE.
3. TCP/IP protocol suite - Forouzan Behrouz A; TMH.

Course Name: **Computer Graphics and Multimedia**
Course Code: **IT605D**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 2

Pre requisites: Computer Programming, Mathematics

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

O1: comprehends introduction about computer graphics system, design algorithms and two-dimensional transformations
O2: familiar with techniques of clipping, three-dimensional graphics and three-dimensional transformations.
O3: familiar with various software programs used in the creation and implementation of multimedia
O4: gain knowledge about hardware devices and software used.

Course Outcome:

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

CO1 Understand the basic computer graphics and Identify different media representations of different multimedia data and data formats, windows, clipping and view-ports object representation.

CO2 Apply the concept of geometric, mathematical and algorithmic concepts

CO3 necessary for programming computer graphics.

CO4 Analyze windows, clipping and view-ports object representation in relation to images displayed on screen.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2	-	2
CO3	3		3	-	-	-	-	-	-	-	-	2	2	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2	3	-	2

Course Contents:

Module I:Overview of Computing Paradigm [3L]

Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing.

Module II: Two-Dimensional Graphics [7L]
Two dimensional geometric transformations, Matrix representations and homogeneous coordinates, composite transformations, Two dimensional viewing, viewing pipeline, viewing coordinate reference frame, window-to-viewport coordinate transformation, Two dimensional viewing functions, clipping operations, point, line, and polygon clipping algorithms.

Module III: Illumination and Color Models [7l]
Height sources, basic illumination models, halftone patterns and dithering techniques, Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model, colour selection. Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms, Pixel addressing and object geometry.

Module IV: Three-Dimensional Graphics [7l]
Three dimensional concepts, Three dimensional object representations, Polygon surfaces, Polygon tables, Plane equations, Polygon meshes, Curved Lines and surfaces, Spline representations, Bezier curves and surfaces, B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modelling transformations, Translation, Rotation, Scaling; Three-dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

Module V: Multimedia System Design & Multimedia File Handling [6l]
Multimedia basics, Multimedia applications, Multimedia system architecture, evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies.

Module VI: Hypermedia [6L]
Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems.

Text Books:

1. Hearn Baker Carithers, - "Computer Graphics with Open GL", Pearson New International Edition.
2. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007.
3. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design , PHI, 2003.

Reference Books:

1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnel, —Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics, CRC Press, 2010.
6. William M. Newman and Robert F.Sproul, — Principles of Interactive Computer Graphics, Mc Graw Hill 1978.

Course Name: **Cloud Computing Lab**
Course Code: **IT691**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites: Networking, Operating System, Web Technology

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

O1: learn and apply the concept of cloud computing in real world application

Course Outcome:

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

CO1 Apply the concept cloud computing to solve practical use cases

CO2 Analyzing different services in cloud computing

CO3 Evaluate different available services provided by cloud vendors

CO4 Design Cloud based application

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	2	-	-	2	-	-	1
CO2	3	3	3	2	2	-	-	-	2	-	2	3	-	-	2
CO3	3	3	3	2	3	-	-	-	2	-	2	3	3	-	2
CO4	3	3	3	4	2	3	2	2	2	-	2	3	3	-	2

Course Contents:

Module I: Virtual Machine:
Creation of vpc, vnet, virtual machine, Private and Public IP configuration

Module II: Application Development:
Implementation of SOAP Web services in JAVA Applications. Use Azure to launch the web applications. Test Simple Application

Module III: Security:
Identity and access management, Multifactor Authentication.

Module IV: Bot and AI service:
Test AWS and AZURE Bot and AI services

Text books:

1. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference books:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

Course Name: **Internet of Things Lab**
Course Code: **IT692**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites: Basic knowledge of Internet of Things with a basic understanding of electronics and microprocessors.

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

O1: learn microcontrollers with application development, product design and prototyping.

Course Outcome:

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

CO1 Develop various sensor interfacing using Visual Programming Language

CO2 Analyze various Physical Computing Techniques

CO3 Evaluate Wireless Control of Remote Devices

CO4 Design Mobile Application which can interact with Sensors and Actuators

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	2	--	--	--	--	--	--	--	3	--	--	--
CO2	3	3	3	2	--	--	--	--	--	--	--	3	2	--	1
CO3	1	3	2	3	--	--	--	--	--	--	--	2	3	--	3
CO4	3	3	1	2	--	--	--	--	--	--	--	2	3	--	3

Course Contents:

1. Digital I/O Interface - Multicolour Led, IR Sensor, PIR, SlotSensor.
2. Analog Read and Write - Potentiometer, Temperature Sensor, Led Brightness Control.
3. Dc Motor Control - Dc Motor Speed and Direction Control.
4. Read data from sensor and send it to a requesting client. (using socket communication)
   Note: The client and server should be connected to same local area network.
5. Fabrication and direction control of wheeled robot using Arduino.
6. Serial Communication - Device Control.
7. Wireless Module Interface - Bluetooth and Wifi.
8. Wireless Control of wheeled Robot using Bluetooth/Wifi.

9. Basic Android App Development using MIT App Inventor.
10. Smart Home Android App Development using App Inventor and Arduino.

Text Books:

1. Sylvia Libow Martinez, Gary S Stager, "Invent To Learn: Making, Tinkering, and Engineering in the Classroom", Constructing Modern Knowledge Press, 2016.

Reference Books

1. Michael Margolis, "Arduino Cookbook", Oreilly, 2011.

Course Name: **Cryptography and Network Security Lab**
Course Code: **IT693**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Prerequisites:

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

O1: To enable students to understand and implement classical and modern cryptographic algorithms.
O2: To develop the ability to apply symmetric and asymmetric key cryptography in secure communications.
O3: To expose students to real-world cryptographic protocols, tools, and applications used in securing networks.

Course Outcome:

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

CO1 Implement classical and modern symmetric encryption techniques.

CO2 Apply public key cryptography and key exchange mechanisms.

CO3 Demonstrate the authentication mechanisms and cryptographic tools for network security.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	2	-	-	-	-	-	-				
CO2	3	2	3	2	2	-	-	-	-	-	-				
CO3	3	2	2	2	3	-	-	-	-	2	-				

Course Contents:

1. Implementation of Caesar Cipher.
2. Implementation of Monoalphabetic Cipher.
3. Implementation of Playfair Cipher.
4. Implementation of Hill Cipher.
5. Implementation of Vigenère Cipher.
6. Implementation of RSA Algorithm.
7. Implementation of Diffie-Hellman Key Exchange Algorithm.
8. Implementation of DES Algorithm.
9. Implementation of AES Algorithm.
10. Implementation of Message Digest (SHA-1 / MD5).
11. Simulation of Digital Signature Algorithm.
12. Simulating IP Security / SSL / TLS using tools like Wireshark or OpenSSL.

Text Books:

1. Cryptography and Network Security: Principles and Practice (7th Edition (or latest)), William Stallings, Pearson Education

Reference Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, McGraw-Hill

7th Semester

Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	IT701	Deep Learning	3	0	0	3	3
2	ENGG	Major	IT702A	Block Chain Technology	3	0	0	3	3
			IT702B	BigData Analytics					
			IT702C	Digital Forensics					
			IT702D	Soft Computing					
3	ENGG	Minor	IT703A	Quantum Computing	3	0	0	3	3
			IT703B	Pattern Recognition					
			IT703C	Bioinformatics					
			IT703D	Cyber Law and IPR					
B. PRACTICAL									
1	ENGG	Major	IT791	Deep Learning	0	0	2	2	1.5
2	ENGG	Internship	IT781	Internship (Min. 1 Month)	0	0	0	0	1.5
3	ENGG	Skill Enhancement Course	PR792	Rapid Prototyping Lab	0	0	0	4	2
4	PRJ	Project	IT782	Minor Project	0	0	0	6	6
Total of Theory, Practical								24	20

Course Name: **Deep Learning**

Course Code: **IT701**

Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre-requisite: Operating System

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

O1:understand the fundamental concepts od Deep learning

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

CO1 To study the basic of tasks and scheduling

CO2 To understand programming languages and databases

CO3 To analyze real time communication

CO4 To analyze evaluation techniques and reliability models for Hardware Redundancy

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	-	2
CO4	3	2	2	3	-	-	-	-	-	-	-	3	3	-	3

Course Content:
Module I: [8L]
Introduction to task scheduling
Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, RM algorithm with different cases-Priority ceiling precedence constraints-using of primary and alternative tasks.

Module II: [8L]
UNI and multiprocessor scheduling-
Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant Scheduling. -Aperiodic scheduling - Spring algorithm, Horn algorithm- Bratley. - Sporadic

scheduling.

Module III: [8L]
Real time Communication: Introduction –
VTCSMA – PB CSMA- Deterministic collision resolution protocol- DCR for multi packet messages- dynamic planning based- Communication with periodic and aperiodic messages.

Module IV: [8L]
Real time databases:
Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Twophase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real
Time System.

Module V: [4L]
Real time modelling and case studies:
Petrinets and applications in real-time modeling, Air traffic controller system – Distributed air defense system.

Text Book:

1. C.M. Krishna, Kang G. Shin, “Real Time Systems”, Tata McGraw - Hil,

Reference book:

1. Giorgio C. Buttazzo, “Hard real-time computing systems: predictable scheduling algorithms and applications”, Springer.
2. C. Siva Ram Murthy, G. Manimaran, “Resource management in real-time systems and networks”, PHI.

Course Name: **Block Chain Technology**

Course Code: **IT702A**

Contact: (3:0:0)

Total Contact Hours: 36

Credit: 3

Pre-requisite: The students must have concept of Distributed Systems, Computer Networks, Cryptography, Python Programming Language.

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

O1:learn and understand Blockchain technology in detail
O2: identifies the application potentials of this technology.

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

CO1 Understand the basic concepts of blockchain and its architectures.

CO2 Analyze different issues in the domain of blockchain and understand the practical applications of blockchain.

CO3 Evaluate and analyze different solutions for the real-life problems related to the blockchain.

CO4 Design different solution applying and analyzing concepts of Block chain

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	2
CO2	2	-	3	2	-	-	-	-	-	-	-	2	3	-	1
CO3	3	3	2	3	-	-	-	-	-	-	-	2	3	-	2
CO4	3	-	3	-	-	-	-	3	-	-	-	2	3	-	2

Course Content:

Module I: [6L]
Centralized Distributed Systems:
Client-Server Model, Distributed System, P2P Network Model, Distributed Database, Two General Problem in distributed database, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

Module II: [6L]
Security, Trust and Privacy:
Confidentiality; Integrity; Availability; Authentication; Authorization; Access Control; Accounting; Non-Repudiation, Symmetric Key and Asymmetric Key Cryptography, Hash function, Merkle tree hash, Digital Signatures – RSA, Schnorr, and ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, User privacy.

Module III: [6L]
Fundamentals of Blockchain:
Introduction, Benefits over traditional distributed database, Blockchain Network, Data structure of block, Block construction and addition, Block mining mechanisms, Merkle Pa-tricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain policy, Real-time application of Blockchain, Soft & Hard Fork, Private, Public, and Consortium blockchain.

Module IV: [9L]
Consensus algorithms in Blockchain:
Distributed Consensus, Nakamoto consensus, Proof of Work (PoW), Proof of Stake (PoS), Proof of Burn (PoB), Delegated Proof of Stake (DPoS), Byzantine Fault Tolerance (BFT), Practical Byzantine Fault Tolerance (PBFT), Ripple Protocol Consensus Algorithm (RPCA), Difficulty Level, Sybil Attack, Energy utilization and alternate.

Module V: [9L]
Cryptocurrency and Blockchain Applications:
History, Distributed Ledger Technology (DLT),Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contracts and Distributed Applications (Apps), GHOST, Vulnerability, Attacks, Sidechain, Namecoin, Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy, Application of Blockchain in Finance and Banking, Energy trading, Internet of Things (IoV, IoD, IIoT, Smart city, Smart Home, and so on), Medical Record Management System, Real estate business, Entertainment, Future scope of Blockchain.

Textbooks:

1. Roger Wattenhofer, Distributed Ledger Technology: The Science of the Blockchain, Second Edition, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, Bitcoin and Cryp-tocurrencyTechnologies: A Comprehensive Introduction, Princeton University Press, 2016.
3. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Publication House, 2014.

Reference books:

1. Melanie Swan Blockchain: Blueprint for a new Economy, O'Reilly Publication House, 2015.
2. Andreas M. Antonopoulos and Dr. Gavin Wood, Mastering Ethereum Building Smart Contracts and DApps, O'Reilly Publication House, First Edition, 2018.

Course Name: **BigData Analytics**

Course Code: **IT702B**

Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre-requisite: Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Programming skills of Python.

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

O1: Comprehend the fundamental concepts of the Big Data Analytics 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).

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

CO1 Understand basic concepts and requirements of big data analytics

CO2 Apply the concept of Big Data analytics to handle huge dataset

CO3 Analyze big data with different available algorithm and ttheorem.

CO4 Design and develop different analytical solution organizing huge dataset

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2	-	2
CO3	3	1	2	-	-	-	-	-	-	-	-	2	3	-	2
CO4	3	1	2	1	-	-	-	-	-	-	-	2	3	-	3

Course Content:

Module I: [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 II: [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 r egression 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 III: [9L]
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 IV: [9L]
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.

Textbooks:
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: **Digital Forensics**

Course Code: **IT702C**

Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre-requisite: Cryptograpgy, Networking

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

O1: understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
O2: understand how to examine digital evidences such as the data acquisition, identification analysis.

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

CO1 To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.

CO2 To understand how to examine digital evidences such as the data acquisition, identification analysis.

CO3 Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.

CO4 To be well-trained as next-generation computer crime investigators.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	1	-	-	-	-	1
CO2	2	-	1	-	-	-	-	-	-	-	-	2	1	-	1
CO3	2	3	2	3	-	-	-	-	-	-	-	2	2	-	1
CO4	2	2	3	2	-	-	3		1	1	-	2	3	1	1

Course Content:

Module I: [4L]
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Module II: [8L]
Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Module III: [10L]
Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Module IV: [8L]
Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Module V: [6L]
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Text Book:
1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.

Reference Book:
1. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
2. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

Course Name: **Soft Computing**
Course Code: **IT702D**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre-requisite: Mathematics, Set theory.

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

O1:gain knowledge of soft computing theories fundamentals, that is of fundamentals of non-traditional technologies and approaches to solving hard real-world problems, namely of fundamentals of artificial neural networks, fuzzy sets, fuzzy logic and genetic algorithms.

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

CO1 Understand the basics of various soft computing techniques.

CO2 Apply different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.

CO3 Analyze the applications of various soft computing techniques.

CO4 Evaluate and create soft computing techniques to solve engineering or real-life problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	-	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	-	3

Course Content:

Module I: [4L]
Introduction:
Soft Computing. Difference between Hard and Soft computing, Requirement of Soft Computing, Major Areas of Soft Computing, Applications of Soft Computing.

Module II: [10L]
Fuzzy Systems:
Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Min-max Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

Module III: [10L]
Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

Module IV: [8L]
Genetic Algorithm: Neural Network, Learning rules and various activation functions, Single layer Perceptron's, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, recent Applications.

Module V: [4L]
Hybrid Systems: Introduction to Hybrid Systems, Neuro Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

Text books:
1. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Willey.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S. Rajasekaran, G. A. Vijayalakshmi, PHI.
3. Genetic Algorithms: Search and Optimization, E. Goldberg

Reference books:
1. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee PHI.
2. Elements of Artificial Neural Network, Kishan Mehrotra, MIT Press.
3. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press.

Course Name: **Quantum Computing**
Course Code: **IT703A**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Concept of Logic Gate, Cryptography

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

O1: introduce the fundamentals of quantum computing. The problem-solving approach using finite dimensional mathematics.

Course Outcome:

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

CO1 Understand basics of quantum computing

CO2 Understand physical implementation of Qubit

CO3 Understand Quantum algorithms and their implementation

CO4 Understand the Impact of Quantum Computing on Cryptography

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	-	-	1	-	-	-	-	-	-	2	-	-	-
CO3	3	2	-	-	1	-	-	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-

Course Contents:

Module I: [4L]

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers

Module II: [8L]
Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement. Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

Module III: [8L]
Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

Module IV: [8L]
Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

Module V: [8L]
Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

Text Book:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

Reference Book:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci Benenti G., Casati G. and Strini G.
2. Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific. Pittenger A. O.
3. An Introduction to Quantum Computing Algorithms.

Course Name: **Pattern Recognition**
Course Code: **IT703B**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Fundamentals of probability and linear algebra

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

O1: learn the fundamentals of pattern recognition and its relevance to classical and modern problems.
O2: identify where, when and how pattern recognition can be applied.

Course Outcome:

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

CO1	Understand basic concepts in pattern recognition techniques, feature extraction techniques and representation of patterns in feature space.
CO2	Apply the various real-world applications in pattern recognition techniques.
CO3	Analyze the application of machine vision, speech recognition and movement recognition used in pattern recognition research.
CO4	Evaluate and create model for Machine Vision, Speech Recognition, Speaker Identification, and Process Identification.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	-	-	-	-	-	-	2	2	-	2
CO2	2	2	2	1	1	-	-	-	-	-	-	2	2	-	1
CO3	2	1	1	1	3	-	-	-	-	-	-	2	2	-	1
CO4	3	1	2	1	1	-	-	-	-	-	-	2	2	-	2

Course Contents:

Module I: [6L]

Introduction to Pattern Recognition:

Importance of Pattern Recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-Supervised Learning.

Module II: [10L]

Classifiers Based on Bayes Decision Theory:

Introduction, Bayes Decision Theory: Minimizing the Classification Error Probability, Minimizing the Average Risk, Discriminant Functions and Decision Surfaces, Bayesian Classification for Normal Distributions: The Gaussian Probability Density Function, The Bayesian Classifier for Normally Distributed Classes, Decision Hyper planes, Minimum Distance Classifiers, Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability Estimation, Bayesian Inference, Maximum Entropy Estimation, Mixture Models, The Expectation Maximization (EM) Algorithm, Application to the Mixture Modelling Problem, Nonparametric Estimation, The Naive-Bayes Classifier, The Nearest Neighbour Rule, Bayesian Networks, Problems.

Module III: [10L] Linear Classifiers

Linear Classifiers

Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm: Proof of the Perceptron Algorithm Convergence, Variants of the Perceptron Algorithm, The Perceptron, The Pocket Algorithm, Kesler's Construction, Least Squares Methods: Mean Square Error Estimation, Multiclass Generalization, Stochastic Approximation and the LMS Algorithm, Sum of Error Squares Estimation, Mean Square Estimation Revisited: Mean Square Error Regression, MSE Estimates Posterior Class Probabilities, The Bias–Variance Dilemma, Logistic Discrimination, Support Vector Machines: Separable Classes, Non separable Classes, The Multiclass Case, v-SVM, Support Vector Machines: A Geometric Viewpoint, Reduced Convex Hulls, Problems

Module IV: [10L] Feature Selection

Introduction, Preprocessing: Outlier Removal, Data Normalization, Missing Data, The Peaking Phenomenon, Feature Selection Based on Statistical Hypothesis Testing: Hypothesis Testing Basics- The Known Variance Case, The Unknown Variance Case, Application of the t-Test in Feature Selection. The Receiver Operating Characteristics (ROC) Curve, Class Separability Measures, Divergence, Chernoff Bound and Bhattacharyya Distance, Scatter Matrices, Feature Subset Selection: Scalar Feature Selection, Feature Vector Selection, Suboptimal Searching Techniques, Optimal Feature Generation, Neural Networks and Feature Generation/Selection, Support Vector Machines: A Last Touch, The Bayesian Information Criterion.

Text books:

1. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th Ed., Academic Press, 2009

Reference books:

1. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006
2. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, John Wiley, 2001

Course Name: **Bioinformatics**
Course Code: **IT703C**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Concepts of Computer Networking, Network Security, Database Management Systems

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

O1: learn about different bio molecules, their structures and functions, various data sets in bioinformatics, computational techniques useful in bioinformatics.

Course Outcome:

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

CO1	Acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2	Understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CO3	Acquire the knowledge of the DNA Sequence Analysis
CO4	Analyze the performance of different types of Probabilistic models used in Computational Biology

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	3	-	-	-	-	-	-	3	-	-	-
CO2	2	3	2	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	-	2	-	3	-	-	-	-	-	-	3	-	-	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	-	3

Course Contents:

Module I: Introduction to Molecular Biology [10L]

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.

Module II: Sequence Databases [5L]
Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank, OMIM, Taxonomy browser, PubMed

Module III: DNA Sequence Analysis [10L]
DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Module IV: Introduction Probabilistic models used in Computational Biology [7L]
Probabilistic Models; Hidden Markov Model: Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics: Gene finding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model: Architecture, Principle, Application in Bioinformatics.

Module V: Biological Data Classification and Clustering [4L]
Assigning protein function and predicting splice sites: Decision Tree

Textbooks:

1. Bio Informatics and Molecular Evolution by Paul G. Higgs and Teresa K. Attwood
2. Bio Informatics Computing by Bryan Bergeron

Reference books:

1. Bio Informatics and Functional Geneomics, by Jonathan Pevsner
2. Gene Cloning DNA Analysis, by T.A. Brown

Course Name: **Cyber Law & IPR**
Course Code: **IT703D**
Contact: (3:0:0)
Total Contact Hours: 36
Credit: 3

Pre requisites: Computer Networking and basic concepts about Network Security and Cryptography.

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

O1: understand, explore and acquire a critical understanding Cyber Law, develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other Cyber Crimes.

Course Outcome:

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

CO1 Understand the policy issues related to electronic filing of documents.

CO2 Identify the importance of lawful recognition for transactions through electronic data interchange and other means of electronic communication.

CO3 Analyze the effectiveness of the prevailing information security law practices.

CO4 Judge the architecture that can cater to the needs of the social information security.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	--	1	1	--	2	--	1	--	--	--	1	--	--	1
CO2	1	3	2	1	--	2	--	2	--	--	--	2	--	--	2
CO3	1	2	2	2	--	1	--	2	--	--	--	1	--	--	1
CO4	1	2	2	2	1	3	--	3	--	--	--	1	--	--	1

Course Contents:

Module I: Introduction of Cybercrime: [6L]

Cybercrime and Offences, Forgery, Hacking, Software Piracy, Computer Network Intrusion, Jurisdiction to Prescribe/Legislative Jurisdiction; Jurisdiction to Adjudicate to Enforce; Cyber Jurisdiction in Civil, Criminals Plan Attacks, Passive Attack, Active Attacks, Unicitral Model Law.

Module II: Information Technology Act: [6L]

Overview of IT Act, Amendments and Limitations of IT Act, Legal Aspects, Indian Laws, IT Act 2000, Public Key Certificate, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication

Module III: Cybercrime Mobile & Wireless Devices: [8L]

Security Challenges Posted by Mobile Devices, Cryptographic Security for Mobile Devices, Attacks on Mobile/Cell Phones, Theft, Virus, Hacking, Bluetooth; Different Viruses on Laptop.

Module V: Phishing & Identity Theft:[4L]

Phising Methods, ID Theft, Online Identity Method.

Module VI: Case Study on Cyber Crimes:[3L]

Harassment Via E-Mails, Email Spoofing (Online a Method of Sending E-Mail using a False Name or E-Mail Address to Make It Appear that the E-Mail Comes from Somebody other than the True Sender), Cyber-Stalking.

Textbooks:

1. Nina Gobole & Sunit Belapune. Cyber security, Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, 2007.
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, 2012.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, 2004.
5. K. Kumar, Cyber Laws: Intellectual property & E Commerce, Security,1st Edition, Dominant Publisher,2011.

Rodney D. Ryder, Guide to Cyber Laws, Second Edition, Wadhwa and Company, New Delhi, 2007.

Reference books:

1. Kenneth J. Knapp, Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions, IGI Global, 2009.
2. Jonathan Rosenoer, Cyber law: the Law of the Internet, Springerverlag, 1997.
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, 2003.
5. Vakul Sharma, Handbook of Cyber Law, Macmillan India Ltd, 2nd Edition, PHI,2003.

Sharma, S.R., Dimensions of Cyber Crime, Annual Publications Pvt. Ltd., 1st Edition, 2004.

Course Name: **Deep Learning Lab**
Course Code: **IT791**
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1.5

Pre requisites:

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

O1: To build the foundation of Deep Learning; to understand how to build the Neural Network and to enable students to develop successful deep learning concept.

Course Outcome:

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

CO1 Make use of deep learning APIs like Keras

CO2 Apply deep learning techniques for object identification and segmentation and implement multiple conversions for Analysis

CO3 Implement RNN and CNN for multiple problems

CO4 Implement Auto encoders and GAN.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	-	-	1	-	-	-	-	1	2	1	2
CO2	3	3	3	2	2	-	-	-	-	-	2	3	3	2	2
CO3	2	2	1	2	3	-	-	-	1	-	-	1	2	2	3
CO4	3	3	3	1	2	-	-	-	-	-	-	3	3	1	3

Course Contents:

Module I: Basic Deep Learning Experiments

1. Create a simple deep learning model that predicts an output (like house price) based on just one input (like area).
2. Extend your model to predict using several inputs (like area, location, and number of rooms).

Module II: Speech and Text Processing

3. Write a program that listens to spoken words and converts them into text.
4. Build a program that reads out a piece of text in a human-like voice.

Module III: Video and Image Processing

5. Create a program that breaks a video into individual image frames.
6. Use an LSTM model to predict future values in a time series (like stock prices or temperature trends).

Module IV: Neural Networks and Logic

7. Design a feedforward neural network to predict outputs of logic gates (AND, OR, XOR, etc.).

Module V: Advanced Image Processing

8. Build a program that separates an image into different regions (like separating a person from the background).

9. Use labeled images to train a model that identifies objects (like cars, dogs, or people) in new images.

Module VI: Image Captioning and Recognition

10. Write a program that describes an image with a sentence using LSTM.
11. Use a Convolutional Neural Network (CNN) to recognize handwritten characters or digits.

Module VII: Object Detection and Generative Models

12. Use the YOLO (You Only Look Once) algorithm to detect dog images.
13. Build an autoencoder model that compresses and reconstructs images of handwritten digits.
14. Create a Generative Adversarial Network (GAN) to generate new, realistic handwritten digits.

Module VIII: Mini Project on Applications of Deep Learning

Text Books:

1. Navin Kumar Manaswi ,Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras , Apress,2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press,2016

Reference Books

1. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition, 2017.
2. https://www.deeplearning.net
3. https://www.deeplearningbook.org/
4. https://developers.google.com/machine-learning/crash-course/ml-intro
5. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
6. http://neuralnetworksanddeeplearning.com/

8th Semester

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
B. PRACTICAL									
1	ENGG	Internship	IT881	Internship (Min. 1 Month)	0	0	0	0	2
2	PRJ	Project	IT882	Major Project	0	0	0	12	12
Total of Theory, Practical								14	14