ASANSOL ENGINEERING COLLEGE

NAAC ‘A’ Accredited

An Autonomous Institute

(Affiliated to Maulana Abul Kalam Azad University of Technology)

R25

B. Tech. CSE (IoT and Cyber security with Block Chain Technology)

Curriculum & Syllabus for B. Tech Under Autonomy (NEP-2020 Implemented)

Department CSE

(Internet of Things and Cyber security including Block Chain Technology)

(Effective from 2025-26 admission batch)

Department: CSE (IOT)

Curriculum Structure & Syllabus (Effective from 2025-26 admission batch)

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

1st Year 2nd Semester(Gr-A)									
	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS201	Data structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	3	0	0	3	3
3	ENGG	Major	CS203	Digital logic and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH20 1	Engineering Chemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	Engineering Mathematics–II	3	0	0	3	3
6	HUM	Value Added Course	HU202	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B.PRACTICAL									
1	ENGG	Major	CS291	Data structure and Algorithms Lab	0	0	2	2	1.5
2	ENGG	Minor	CS292	Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	CS293	Digital Electronics and Computer Organization Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH29 1	Engineering Chemistry Lab	0	0	3	3	1
5	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
	C. MANDATORY ACTIVITIES / COURSES								
1	Mandatory Course	Mandatory Course	MC 281	NSS/Physical Activities/ Meditation & Yoga / Photography/ Nature Club	**0**	**0**	**0**	**0**	

Total of Theory , Practical	**29**	**22**

2nd Year 3rd Semester

Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
A. THEORY					L	T	P	Total	
1	ENGG	Major	IOT301	Cryptography and Cyber Security	3	0	0	3	3
2	ENGG	Major	IOT302	Computer Architecture and Organization	3	0	0	3	3
3	ENGG	Major	IOT303	Design & Analysis of Algorithm	3	0	0	3	3
4	ENGG	Minor	CS(IOT)304	Database Management System	3	0	0	3	3
5	ENGG	Minor	IT(IOT)301	(Probability and Statistics)	3	0	0	3	3
		B. PRACTICAL							
1	ENGG	Minor	IOT391	Cryptography and Cyber Security Lab	0	0	3	3	1
2	ENGG	Major	IOT392	Computer Architecture and Organization Lab	0	0	3	3	1.5
3	ENGG	Major	IOT393	Essentials of Cyber security Lab	0	0	3	3	1.5
4	ENGG	Major	IOT394	Database Management System Lab	0	0	3	3	1.5
5	ENGG	Major	IOT395	Python Programming Lab		0	3	3	1.5
		TOTAL CREDIT							22

2nd Year4th Semester

Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
A.THEORY					L	T	P	Total	
1	ENGG	Major	IOT401	Machine Learning	3	1	0	4	4
2	ENGG	Major	IOT402	Data Communication and Network	3	0	0	3	3
3	ENGG	Major	IOT403	System Security/Ethical Hacking	3	0	0	3	3
4	HUM	Major	IOT404	Operating System	3	0	0	3	3
5	SCI	Minor	IOT401	Pattern Recognition	3	0	0	0	3
B. PRACTICAL									
1	ENGG	Major	IOT491	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	PRJ	IOT493	Android Application Development/Project	0	0	3	3	1.5
3	ENGG	Major	IOT492	Data Communication and Network lab	0	0	3	3	1.5
4	ENGG	Minor	IOT494	Operating System Lab	0	0	3	3	1.5
		TOTALCREDIT							22

3rd Year 5th Semester

Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
A.THEORY					L	T	P	Total	
1	ENGG	Major	IOT501	IoT Application and Design	3	0	0	3	3
2	ENGG	Major	IOT502	Secure Coding/ Malware Analysis	3	0	0	3	3
3	HUM	Minor	HU(IOT)503	Cyber Law and Ethics	3	0	0	3	3
4	ENGG	Minor	IT(IOT)501	User Interface Design/ Information and Coding Theory	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(IOT)501	Business Communicationand ValueScience	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IOT591	IoT Application and Design Lab	0	0	3	3	1.5
2	ENGG	Major	IOT592	Malware Analysis Lab	0	0	3	3	1.5
3	ENGG	PRJ	IOT593	Project	0	0	3	3	1.5
4	Skill Enhancement Course	Internship	IOT581	Internship/Industrial Training	0	0	2	2	2
		TOTALCREDIT							20.5

3rd Year 6th Semester

Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
A. THEORY					L	T	P	Total	
1	ENGG	Major	IOT601	Cyber Forensics	3	0	0	3	3
2	ENGG	Major	IOT602	Cloud Computing	3	0	0	3	3
3	ENGG	Major	IOT603	Object Oriented Programming	3	0	0	3	3
4	ENGG	Major	IOT604	Formal Language and Automata Theory	3	0	0	3	3
5	ENGG	Major/Elective	IOT605A	Wireless Sensor Network Security	3	0	0	0	3
			IOT605B	Mobile and Wireless Security					
			IOT605C	Social Network Analysis					
B. PRACTICAL									
1	ENGG	Major	IOT691	Cyber Forensics Lab	0	0	3	3	1.5
2	ENGG	Major	IOT692	Cloud Computing Lab	0	0	3	3	1.5
3	ENGG	Major	IOT693	Object Oriented Prog. Lab	0	0	3	3	1.5
4	ENGG	PRJ	IOT694	Project				1.5	2
		TOTALCREDIT							21.5

4th Year7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
		A.THEORY			L	T	P	Total	
1	ENGG	Major	IOT701	Secure Software Engineering	3	0	0	3	3
2	ENGG	Major	IOT702	Deep Learning	3	0	0	3	3
3	ENGG	Minor	IT(IOT)701	Web Application Security	3	0	0	3	3
4	ENGG	Major	IOT703A	Blockchain Technology	3	0	0	3	3
			IOT03B	Quantum Cryptography					
			IOT703C	Cyber Analytics					
		B. PRACTICAL							
1	ENGG	Major	IOT791	Secure Software Engineering Lab	0	0	3	3	1.5
2	ENGG	Major	IOT792	Deep Learning Lab	0	0	3	3	1.5
3	ENGG	Minor	IT(IOT)791	Web Application Security Lab	0	0	3	3	1.5
4	ENGG	Major	IOT 793A	Blockchain Technology Lab	0	0	3	3	1.5
			IOT793B	Quantum Cryptography Lab					
			IOT793C	Cyber Analytics Lab					
5	ENGG	PRJ	IOT781	Project	0	0	8	8	4

TOTALCREDIT					22

4th Year8th Semester

Sl. No.	Broad Category	Category	CourseCode	Course Title	Hoursperweek				Credits
A. THEORY					L	T	P	Total	
1	ENGG	Major	IOT801A	Real-TimeSystems	3	0	0	3	3
			IOT801B	Vulnerability Assessment and Penetration Testing					
			IOT801C	Soft Computing					
2	HUM	Minor	HU(IOT)801	Human Resource Developmentand OrganizationalBehavior	3	0	0	3	3
B. PRACTICAL									
1	ENGG	PRJ	IOT881	Project	0	0	16	16	11
2	ENGG	Grand Viva	IOT882	GrandViva	0	0	0	0	2
		TOTALCREDIT							19

Distribution of credits

Sem	Major	Minor	Multi-Disciplinary	Ability Enhancement Scheme	Skill Enhancement Course	Value Added Course	Project	Internship	Grand Viva	Total
1	4.5	0	6	**1.5**	3	3	0	0	0	18
2	9	3.5	5	**1**	2.5	1	0	0	0	22
3	15	7	0	0	0	0	0	0	0	22
4	16	4.5	0	0	0	0	1.5	0	0	22
5	9	6	0	2	0	0	1.5	2	0	20.5
6	19.5	0	0	0	0	0	2	0	0	21.5
7	13.5	4.5	0	0	0	0	4	0	0	22
8	3	3	0	0	0	0	11	0	2	19
Total	89.5	28.5	11	4.5	5.5	4	20	2	2	167

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

THEORY

SYLLABUS
Semester I

Course Name: Introduction to Programming for problem solving
Course Code: CS 101

Contact (Periods/Week):3L/Week
Total Contact Hours: 36
Credits: 3

Course Outcome(s):

CO1: To identify the working principle of input and output devices of Computers memorize the basic terminology used in computer programming.

CO2: To express programs in C language and use different data types for writing the programs.

CO3: To implement programs using the dynamic behavior of memory by the use of pointers.

CO4: To explain the difference between call by value and call by address.

CO5: To write programs using basic data files and developing applications for real world problems.

CO-PO-PSO Mapping:

	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	3	3	2	2						3	2	3	3
CO2	2	2	3	3	3						3	2	2	3
CO3	2	3	2	2	2						3	2	3	2
CO4	3	2	2	3	3						2	2	2	2
CO5	2	2	2	1	1						3	3	3	3

Course Content:

Module-1: Fundamentals of Computer (9L)

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices.

Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using1's complement and 2's complement). Representation of Characters-ASCII Code, Basics of Compiler, Interpreter and Assembler

Problem solving – Basic concept of Algorithm. Representation of algorithm using flowchart and pseudo code, Some basic examples.

Module-2: Introduction to C Programming (5L)

Overview of Procedural vs Structural language; History of C Programming Language. Variable and Data Types: The C characters identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions: Arithmetic operators, relational operators, Logical operators, increment and decrement operators, bitwise operators, Assignment operators, conditional operators, special operators-type Conversion, C expressions, precedence and associativity. Input and Output: Standard input and output, formatted output–printf, formatted input scanf.

Module-3: **Branch and Loop (5L)**

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder. Switch Case: break and continue; switch-case, concept of go to and labels Loops- while, for, do while.

Module-4: Program Structures (4L)

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function.

Storage Class in C: Storage Class-auto, external, static and registers to rage class, scope rules and lifetime of variables

C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: **Array and Pointer (7L)**

Arrays: One dimensional array, Two-dimensional arrays Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions.
Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String. Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum (3L)

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C (3L)

Files handling-opening and closing a file indifferent mode, formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y.- Let us C, BPB Publication, 15th Edition

Reference Books:

1. Brian W.Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad– MASTERINGC, TMH, 2nd Edition

Course Name: Engineering Physics Course
Code: PH101
Contact: (3:0:0)
Total Contact Hours: 36
Credits: 3
Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of courses in Physic-I is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' should be able to

CO	Description
CO1	explain basic principles of laser and optical fibers.
CO2	understand the properties of Nano material.
CO3	analyze different crystallographic structures according to their co-ordination number and packing factors.
CO4	analyze the structure, function and characteristics of different storage devices.
CO5	justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

CO-PO Mapping:

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

Course Content:
Module 1 (12L) Modern Optics

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

and equations, working principle of laser, meta stable 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, viewing of holography, applications 3L

Module 2 (6L) Solid State Physics

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. 3L

Module 3 (8L) Quantum Mechanics

3.01 **Quantum Theory**: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 4L

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

Module 4 (4L)

Physics of Nano materials

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 (6L)

Storage and display devices

Different storage and display devices-Magnetic storage materials, Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive), Operation and application of CRT, CRO, Liquid crystal display (LCD), LED, OLED, Plasma display, Thin film transistor display).

Recommended Text Books for Physics I:

Text Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser

Principles of engineering physics – Md. N Khan and S Panigrahi.

COURSE NAME : Engineering Mathematics

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 concept of (10+2) standard matrix algebra, and calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to matrix algebra and calculus.

CO2: Determine the solutions of the problems related to matrix algebra and calculus.

CO3: Apply the appropriate mathematical tools of matrix algebra and calculus for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra and calculus.

CO-PO/PSO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11
CO1	3	2	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	1
CO	**2.75**	**2.25**	**1.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1.25**

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

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; Eigen values 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; Concept of sequence and series, Power series; 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. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Course Name: Environmental Science; Paper Code: HU101
Contact (L: T: P): 2 : 0 : 0; Total Contact Hours: 24; Credit: 2

Course Objective(s)

This course will enable the students to,

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

Course Outcome

CO	**Statement**
CO1	Able to understand the natural environment and its relationships with human activities
CO2	The ability to apply the fundamental knowledge of science and engineering to assess
CO3	environmental and health risk
CO4	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO5	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

CO – PO Mapping

CO	Statement	PO1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	Able to understand the natural environment and its relationships with human activities	2	2	3	-	-	2	3	3	-	-	2
2	The ability to apply the fundamental knowledge of science	3	3	3	1	1	2	3	3	-	-	2

	and engineering to assess environmental and health risk											
3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues	3	3	3	2	1	2	3	3	-	-	2
4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.	1	1	1	1	2	2	3	3	-	-	2
AVERAGE		2	2	2	1	1	2	3	3	-	-	1

Module 1 - Resources and Ecosystem (6L)

1. **Resources (2L)**
   Types of resources, resistance to resources, Human resource, Population Growth models: Exponential Growth, logistic growth
2. **Ecosystem (3L)**
   Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Food chain, Food web.
3. **Energy and Environment(1L)**

   Conventional energy sources, coal and petroleum, Green energy sources, solar energy, tidal energy, geothermal energy, biomass

Module 2 – Environmental Degradation (9L)

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 (3L)**
   Water Pollutants, Oxygen demanding wastes, heavy metals, BOD, COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal poisoning and toxicity.
3. **Land Pollution and its impact on Environment (2L)**
   Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-

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4. **Noise Pollution and its impact on Environment (1L)**
   Types of noise, Noise frequency, Noise pressure, Noise intensity, Noise Threshold limit, Effect of noise pollution on human health.

Module 3 – Environmental Management (6L)

1. **Environmental Impact Assessment (1L)**
   Objectives of Environmental management, Components of Environmental Management, Environmental Auditing, Environmental laws and Protection Acts of India
2. **Pollution Control and Treatment (2L)**
   Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator, etc., Waste Water Treatment, Noise pollution control.
3. **Waste Management (3L)**
   Solid waste management, Open dumping, Land filling, incineration, composting, E-waste management, Biomedical Waste management.

Module 4 – Disaster Management (3L)

1. **Study of some important disasters (2L)**
   Natural and Man-made disasters, earthquakes, floods drought, landside, cyclones, volcanic eruptions, tsunami, Global climate change. Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.
2. **Disaster management Techniques (1L)**
   Basic principles of disasters 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

Paper Name: Indian knowledge System Paper Code: HU102
Credit: 01; No. of lectures: 12

Module-1 (3L)

An overview of Indian Knowledge System (IKS): 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.

Module-2 (3L)

Salient features of the Indian numeral system - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers.

Highlights of Indian Astronomy: Historical development of astronomy in India

Module-3 (3L)

Indian science and technology heritage - Metals and metalworking - Mining and ore extraction – Physical structures in India - Irrigation and water management - Dyes and painting technology - Surgical Techniques - Shipbuilding

Module-4 (3L)

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs.

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.

References:

1. Introduction to Indian knowledge system: concepts and applications-Mahadevan B.Bhat, Vinayak Rajat, Nagendra Pavana R.N.,PHI
2. Traditional Knowledge system in India, Amit Jha, Atlantic Publishers
3. S. N. Sen and K. S. Shukla, History of Astronomy in India, Indian National Science Academy, 2nd edition, New Delhi, 2000

PRACTICAL

SYLLABUS
Semester I

Course Name : Programming for problem solving

Lab Course Code: CS191

Contact Hours: 3L/Week Total
Contact Hours: 36 Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the working of different operating systems like DOS, Windows, Linux
CO2	To express programs in C language
CO3	To implement programs connecting decision structures, loops
CO4	To experiment with user defined functions to solve real time problems
CO5	To write C programs using Pointers to access arrays, strings, functions, structures and files

CO-PO-PSO 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	3	3	2	2						3	2	3	3
CO2	2	2	3	3	3						3	2	2	3
CO3	2	3	2	2	2						3	2	3	2
CO4	3	2	2	3	3						2	2	2	2
CO5	2	2	2	1	1						3	3	3	3

Course Content:

Module- 1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types
b) Different arithmetic operators.
c) Printf() and scanf() functions.

Module-3: Problem based on conditional statements using

a) if-else statements
b) different relational operators
c) different logical operators

Module-4: Problem based on

a) **for** loop
b) **while** loop
c) **do-while** loop

Module-5: Problem based on

a) How to write a menu driven program using switch-case statement
b) How to write a function and passing values to a function
c) How to write a recursive function.

Module-6: Problem based on

a) How to use array (bothI-Dand2-D).
b) How to pass an array to a function.

Module-7: Problem based on manipulation of strings in different way.

Module-8: Problem based on

a) How to handle compound variable sin C
b) How to handle file in C
c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

2. Kanetkar Y.-Let us C, BPB Publication,15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India K R Venugopal & S R Prasad–MASTERINGC,TMH, 2nd Edition

Course Name: Engineering Physics Lab
Course Code: PH 191
Contact Hours: 0:0:3
Credit: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students’ will be able to
CO1 : demonstrate experiments allied to their theoretical concepts
CO2 : conduct experiments using LASER, Optical fiber.
CO3 : participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO4 : analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiment.
CO5: Design solutions for real life challenges.

CO-PO Mapping:

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

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Content:

General idea about Measurements and Errors (One Mandatory):
Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.

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.

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. Study of characteristics of solar cell.

Perform at least one of the following experiments:

11. Calibration of an oscillator using Lissajous Figure.
12. Determination of specific charge of an electron (e/m) by J. J Thompson Method.

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

Probable experiments beyond the syllabus:

1. Study of dispersive power of material of a prism.
2. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
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 Books:

1. Practical. 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 & Design Lab
Course Code: ME194

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: Learn

the basics of drafting

CO2: Understand the use of drafting tools which develops the fundamental skills of industrial drawings.
CO3: Apply the concept of engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.
CO4: Analyse the concept of projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
CO5: Evaluate the design model to different sections of industries as well as for research & development.

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

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th 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; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

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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	PSO 1	PSO 2	PSO 3
CO1	2			2								2	2	2
CO2	2			2								2	2	2
CO3	3			2								2	2	2
CO4	3			3								3	3	2
CO5	3	2		3	2							3	3	2

Paper Name: Professional Communication & Presentation Skill

Lab Paper Code: HU191

Contact: (0:0:3)
Total Contact Hours: 26
Credit: 1.5

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcome:

By pursuing this course the students will be able to:
CO1: Recognize, identify and express advanced skills of Technical Communication in English through Language Laboratory.
CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3: Articulate and present the skills necessary to be a competent Interpersonal communicator.
CO4: Deconstruct, appraise and critique communication behaviours.
CO5: Adapt, negotiate and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Listening in Business Telephony

Module 3: Speaking

a. Speaking—Accuracy and Fluency Parameters
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. Accuracy-focused activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice

f. Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations

Module 4: Lab Project Work

a. Writing a Book Review
b. Writing a Film Review
c. Scripting a Short Presentation (2 minutes)
d. Making a short video CV (1-2 minutes)

References:

1. IT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PO Mapping

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

1st Year 2nd Semester(Gr-A)									
	Broad Category	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CS201	Data structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	3	0	0	3	3
3	ENGG	Major	CS203	Digital logic and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH20 1	Engineering Chemistry	2	0	0	2	2
5	SCI	Multidisciplinary	M201	Engineering Mathematics–II	3	0	0	3	3
6	HUM	Value Added Course	HU202	Constitution of India & Professional Ethics	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU203	Design Thinking & Innovation	1	0	0	1	1
B.PRACTICAL									
1	ENGG	Major	CS291	Data structure and Algorithms Lab	0	0	2	2	1.5
2	ENGG	Minor	CS292	Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	CS293	Digital Electronics and Computer Organization Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH291	Engineering Chemistry Lab	0	0	3	3	1
5	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
	C. MANDATORY ACTIVITIES / COURSES								
1	Mandatory Course	Mandatory Course	MC 281	NSS/Physical Activities/ Meditation & Yoga / Photography/ Nature Club	**0**	**0**	**0**	**0**	

Total of Theory , Practical	**29**	**22**

THEORY

SYLLABUS
Semester II

Course Name: Data Structures
Course Code: CS201
Contact (Periods/Week): 3L/Week
Total Contact Hours: 36
Credits: 3

Course Objectives:
1. To learn the basics of abstract data types.
2. To learn the principles of linear and nonlinear data structures.
3. To build an application using sorting and searching.

Course Outcomes:

CO1: To identify how the choices of data structure & algorithm methods impact the performance of program.
CO2: To express problems based upon different data structure for writing programs.
CO3: To implement programs using appropriate data structure & algorithmic methods for solving problems.
CO4: To explain the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5: To write programs using dynamic and static data structures and building applications for real world problems.

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2		2	3						1	1	1	1
CO 2	3	2	2	2	2							3	2	2
CO 3	2	3	3	2	3						1	3	3	3
CO 4	2	2	2	3	1							2	1	2
CO 5	2	3	3	3	2						1	3	3	3
	2.40	**2.40**	**2.50**	**2.40**	**2.20**							**2.40**	**2.00**	**2.20**

Course Content:

Module 1: Introduction [4L]

Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures. (1L) Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Small Oh(o), Big Omega(Ω), Small Omega(ω) and Theta(ϴ) notation (definition and significance). (3L)

Module 2: Non-Restricted Linear Data Structure [9L]

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

Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array- representation of polynomial using array, Representation of Sparse matrix using array. Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.

Module 3: Restricted Linear Data Structure [6L]

Stack: Definition of Stack, implementations of stack using array and linked list, Applications of stack- infix to postfix conversion, Postfix Evaluation

Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion. Queue: Definition of Queue; Implementation of queue using array-physical, linear and circular model; Implementation of queue using linked list.

Dequeue- Definition and different types of dequeue.

Module 4: Nonlinear Data structures [9L]

Trees and Binary Tree:

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

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

Binary search tree- Definition, insertion, deletion, searching algorithm;

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

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

Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm.

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

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

Module 5: Sorting and Searching [8L]

Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm (internal, external,

st ab le, in-place, comparison based); Factors affecting sorting Methods, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort – algorithm with analysis (time complexity) Searching: Factors affecting searching Methods; Sequential search –algorithm with analysis (time complexity);
Binary search algorithm with analysis (time complexity)
Hashing: Introduction and purpose of Hashing and Hash functions (division, folding and mid-square), Collision resolution techniques.

Textbook:

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

Reference Books:

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

COURSE NAME : **Introduction to Artificial Intelligence**
PAPER CODE : CS 202

Contact (L: T: P): 2:0:0
Total Contact Hours: 30
Credit: 2

Course Objectives:
The objectives of this course are to enable students to
1. Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context.

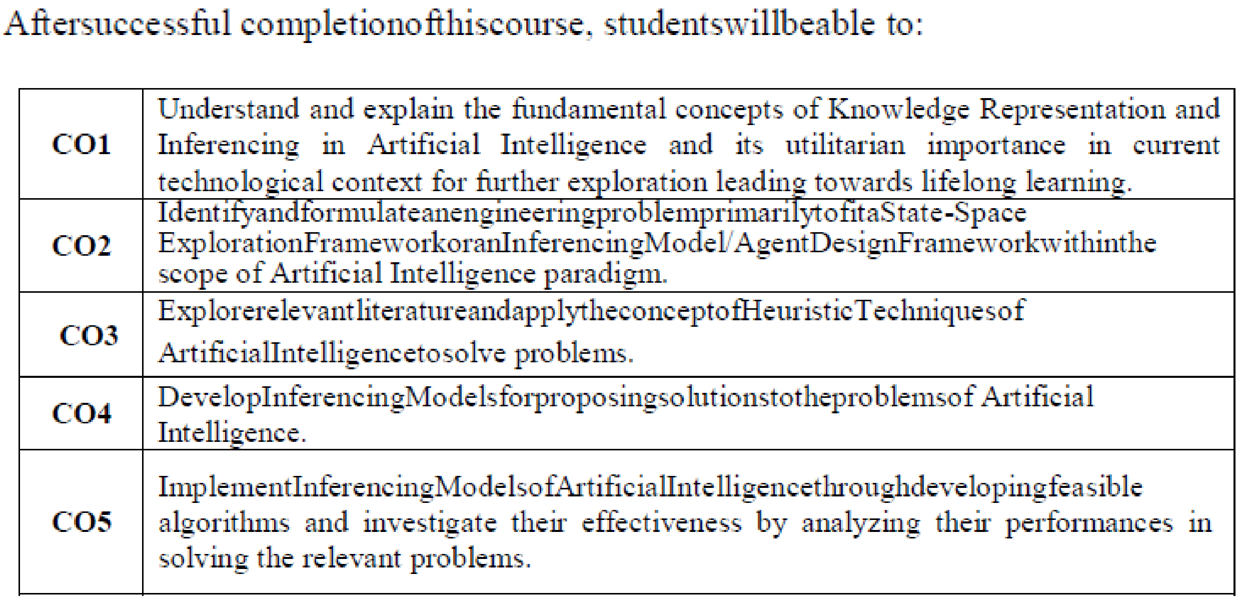
2. Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.

3. Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute- force techniques.

4. DesignAI-Frameworks for Inferencing based onknowledge base.

5. Analyze the effectiveness of AI-Inferencing Model in offering solutions to the respective problem

Course Outcomes:



Aftersuccessful completionofthiscourse, studentswillbeable to:

CO1	Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	IdentifyandformulateanengineeringproblemprimarilytofitaState-Space ExplorationFrameworkoranInferencingModel/AgentDesignFrameworkwithinthe scope of Artificial Intelligence paradigm.
CO3	ExplorerelevantliteratureandapplytheconceptofHeuristicTechniquesof ArtificialIntelligencetosolve problems.
CO4	DevelopInferencingModelsforproposingsolutionstotheproblemsof Artificial Intelligence.
CO5	ImplementInferencingModelsofArtificialIntelligencethroughdevelopingfeasible algorithms and investigate their effectiveness by analyzing their performances in solving the relevant problems.

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

Course contents:

Module1:IntroductiontoArtificialIntelligence(3 L)

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

Module2:IntelligentAgentsandLogic-BasedThinking(8L)

Intelligent systems • Agents and environments • Decision making using rules and logic • Symbolic AIconcepts • Propositional Logic: Knowledge Representation and Inferenceusing Propositional Logic •Predicate Logic :Knowledge Representation, Inference, and Answer

Extraction using First OrderPredicateLogic

Module3:OverviewofAIBranchesandPerception(8 L)

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

Module4:**BasicsofMachineLearning(6L)**
What I smachine learning • AI vs ML• Types of learning : supervised ,unsupervised •Concept of dataset,features,andlabels •ML model and prediction flow • Common ML applications
• Introduction to decision trees (conceptonly)•MLpipeline overview

Module5:**ApplicationsandEthicsofAI(5L)**
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 AIethics: bias, fairness, privacy •Career opportunities and future
Scopes in AI

Textbook:
1. Saptarsi Goswami, Amit Kumar Das, Amlan Chakrabarti-AI for Everyone:A Beginner's Handbook for Artificial Intelligence (AI), Pearson.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
3. Russell, S.andNorvig,P.2015.Artificial Intelligence-A Modern Approach,3rd edition,PrenticeHall.

ReferenceBooks:
1. ReemaThareja,Artificial Intelligence:BeyondClassicalAI,Pearson.
2. Patterson, Introduction to Artificial Intelligence and Expert Systems,Pearson.

Course Name: Digital Logic and Computer Organization Course
Code: CS203
Contact Hours: 3:0:0
Total Contact Hours: 36
Credits: 3

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

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

Course Outcomes (COs):

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

CO1	Interpret and apply number systems and Boolean algebra to design digital circuits.
CO2	Design and analyze combinational and sequential logic circuits using standard ICs or logic gates.
CO3	Demonstrate and execute arithmetic operations using hardware-based algorithms for fixed and floating-point numbers.
CO4	Explain and model CPU organization, instruction execution, and control unit operations.
CO5	Evaluate and compare memory organization and I/O mechanisms with respect to performance and functionality.

Course Content

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

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

Module 2: Combinational Circuits (6L)

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

Module 3: Sequential Circuits & Registers (6L)

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

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

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

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

- Register Transfer Language (RTL), Bus Architecture, Micro-operations [1L]
- ALU Design, Status Flags, General Register & Stack Organization [2L]

- Control Unit: Hardwired vs. Microprogrammed Control, Sequencing [2L]
- Basic Instruction Cycle and Execution Pipeline [1L]

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

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

Textbooks:

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

Reference Books:

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

Course Name: Engineering Chemistry
Paper Code: CH(CS)201
Total Contact Hours: 24
Credit: 2

Prerequisites:

COURSE OBJECTIVE

To understand the basic principles of elements, organic reactions, drug synthesis and technological aspects of modern chemistry

To apply the knowledge of different engineering materials, advanced polymers, and nanomaterials to solve complex engineering problems

To analyse and evaluate quality parameters of water and its treatment

Apply the knowledge of free energy, energy storage device, semiconductors, fuels and corrosion to design environment friendly & sustainable devices

Apply the knowledge of different instrumental techniques to analyse unknown engineering materials.

COURSE OUTCOME

CO1. Able to understand the basic principles of elements, organic reactions drug synthesis and computational chemistry

CO2. Able to apply the knowledge of different engineering materials, advanced polymers, and nanomaterials to solve complex engineering problems

CO3. Able to analyse and evaluate water quality parameters and its treatment

CO4. Able to the knowledge of free energy, energy storage device, fuels and corrosion to design environment friendly & sustainable devices

CO5. Able to apply the knowledge of different instrumental techniques to analyse unknown engineering materials

CO v/s PO MAPPING

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

COURSE CONTENT

Module 1 - Elements and their properties (6L)

1. **Elements and their properties (3L)**
   Bohr's theory for one electron system, Hydrogen spectrum, Quantum numbers, atomic orbitals, Pauli's

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clusion principle, Hund's rule, exchange energy, Aufbau principle, Electronic configuration and Magnetic properties.

2. **Periodic Table for Engineers (3L)**
   Modern Periodic table, Periodic properties, study of advanced functional materials like Silicones, Silicates, Zeolite and alloys like steel, mischmetall, Neodymium alloy and their applications.

Module 2 - Energy devices and Semiconductors (6L)

1. **Use of free energy in chemical equilibria (3L)**
   Laws of Thermodynamics, Enthalpy, Entropy, Spontaneity, Electrochemical Cell, Dry Cell, Mercury Cell, Lead Storage batteries, Ni-Cd Cells, Fuel Cells, Solar Cells, Nernst equation and applications, Electrochemical sensors
2. **Crystals and Semiconductors (3L)**
   Crystals and their defects, Stoichiometric and Non-stoichiometric defects, Band theory and Doping, n- type and p-type semiconductors, Superconductors

Module 3 –Industrial Applications of Chemistry (8L)

1. **Advanced Polymeric materials (3L)**
   Classification, Engineering Plastics, conducting polymers, bio polymers, polymer composites
2. **Industrial corrosion (2L)**
   Classification, Effects of corrosion, Preventive measures
3. **Analysis of Water Quality (1L)**
   Physicochemical and Biological parameters
4. **Nano materials (1L)**
   Synthesis of Nano materials, Applications in modern devices
5. **Basic Computational Chemistry (1L)**
   Introduction of computational chemistry and their applications

Module 4 – Organic Reaction Products and their spectroscopic analysis (4L)

2. **Organic Reactions (2L)**
   Substitution, Elimination and Addition reactions
3. **Drug designing and synthesis (1L)**

   Paracetamol, Aspirin
4. **Spectroscopic Analysis (1L)** UV – Visible Spectra, IR spectra

Course Name:
Engineering Mathematics -
II Paper Code: M(CS)201
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 concept of (10+2) standard calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform and numerical methods. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to ordinary differential equations, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using ordinary differential equation, Laplace transform and numerical Methods.

CO-PO/PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11
CO1	3	2	-	-	-	-	-	-	-	-	2

CO2	3	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	1
M(CS) 201	**2.75**	**2.25**	**1.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1.25**

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

Course Content:

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

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

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

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

Solution of second order ODE with constant coefficients: C.F. &P.I., Method of variation of parameters, Cauchy-Euler equations.

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

Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of tf(t), LT of f(t)t, LT of derivatives of f(t), LT of integral of f(t), Evaluation of 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.

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t Books:

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

Reference Books:

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

COURSE NAME : Constitution of India & Professional Ethics
SUBJECT CODE : HU202
Contact (L: T: P): 1:0:0
Total Contact Hours: 12
Credit: 1

Module 1: History of Making of the Indian Constitution: History. Drafting Committee, (Composition & Working) **3L**
Philosophy of the Indian Constitution: Preamble Salient Features
Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy **6L**

The Right to Equality
The Right to Freedom: I (Article 19)
The Right to Freedom: II (Articles 20, 21 and 22) The
Right against Exploitation
The Right to freedom of Religion

Cultural and Educational rights The
Right to Property
The Right to Constitutional Remedies
Fundamental Duties

Module-3: Organs of Governance: 3L

Parliament - Composition - Qualifications and Disqualifications -Powers and Functions – Executive-President -Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

Text / Reference Books:

1) Indian Constitution by D. D. Basu, The Publisher, LexisNexis
2) Constitution of India by Subhas C Kasyap, Vitasta Publishing
3) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
4) Indian Constitution Text Book - Avasthi, Avasthi,Publisher: LAKSHMI NARAIN AGARWAL
5) Introduction to the Constitution of India, Brij Kishore Sharma, PHI

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**	**Mappingto POs**
	1.	Analyze emotional experience and expressions to better understand stakeholders whiledesigning 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	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.

Module	Content	Hour
Module 1:	**Basics of Design Thinking:** Definition of Design Thinking, Need for Design Thinking, history of Design Thinking, Concepts & Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;	2

Module 2:	**PROCESS OF DESIGN: Understanding Design thinking** Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping. Stages of Design Thinking Process (explain with examples) – Empathize (Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis). Define (Methods of Define Phase: Storytelling, Critical items diagram, Define success). Ideate (Brainstorming, 2X2 matrix, 6-3-5 method, NABC method). Prototype (Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product). Test (Methods of Testing: Feedback capture grid, A/B testing).	4

Module 3:	**Tools for Design Thinking** Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space– Empathy for design – Collaboration in distributed Design	2
Module 4:	**Design Thinking in IT** Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenariobased 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

PRACTICAL

SYLLABUS
Semester II

Course Name: Data Structures Lab
Course Code: CS291
Contact (Periods/Week): 3P/Week
Total Contact Hours: 36
Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the appropriate data structure as applied to specified problem definition.
CO2	To summarize operations like searching, insertion, deletion, traversing mechanism used on various data structures.
CO3	To implement practical knowledge of data structures on the applications.
CO4	To illustrate how to store, manipulate and arrange data in an efficient manner.
CO5	To write programs to access queue and stack using arrays and linked list, binary tree and binary search tree.

CO-PO-PSO 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	3	3	2	3	-	-	-	-	-	2	1	1	1
CO2	3	2	2	3	3	-	-	-	-	-	2	3	2	2
CO3	2	3	3	-	2	-	-	-	-	-	2	3	3	3
CO4	2	2	1	3	2	-	-	-	-	-	3	2	1	2
CO5	2	2	3	1	2	-	-	-	-	-	3	3	3	3
	2.4	2.4	2.4	2.3	2.4	-	-	-	-	-	2.4	2.4	2	2.2

Course Content:

Module 1: Implementing Non-Restricted Linear Data Structure [2 Lab]
Problem based on Implementation of Non-Restricted Linear Data Structure like- Implementation of list as data structure using array. Implementation of list as data structure using linked list of different types. Implementation of polynomial as data structure using array and linked list.

Module 2: Implementing Restricted Linear Data Structure [3 Lab]
Problem based on Implementation of Restricted Linear Data Structure like- Implementation of stack as data structure using array. Implementation of stack as data structure using linked list. Implementation of queue as data structure using array (physical, linear and circular model). Implementation of queue as data structure using linked list.

Module 3: Implementing Non-Linear Data Structure [2 Lab]
Problem based on Implementation of Non-Linear Data Structure like Implementation of Binary Tree as data structure using array and linked list. Implementation of Binary Search Tree (BST) as data structure using linked list. Implementation of Heap as data structure using array. Implementation of Priority Queue as data structure using Heap.

Module 4: Implementing Sorting and Searching algorithm [5 Lab]
Problem based on Implementation of Sorting and Searching algorithm
Implementation of Bubble sort using appropriate data structure.
Implementation of Selection sort using appropriate data structure.

Implementation of Insertion sort using appropriate data structure.
Implementation of Quick sort using appropriate data structure.
Implementation of Merge sort using appropriate data structure.
Implementation of Sequential Search using appropriate data structure.
Implementation of Binary Search using appropriate data structure.

Text books:

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

Reference books:

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

Course Name: Artificial Intelligence Lab

Code: CS292
Contact Hours: (L:T:P) 0:0:3
Total Contact Hours: 30
Credit: 1.5

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

CourseOutcomes(COs):

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

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

CO-PO-PSO 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	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	2	-	-	-	-	-	2	2	2	3

Course Contents:

Module 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 Vusing PROLOG programming and its working strategy.

Understanding facts, rules, queries, and syntax.

Module2:Recursive definitions in Prolog

Fibonacci Series,Calculator,Factorial,summation,listlength,etc.Usingrecursive rules.

Module3:Defining facts and simple queries

Writing aknowledge base for family relationships,basic objects.

Module4:**Rules and inference in Prolog**

Creating logical rules and testing inferences.

Module5:ListoperationsinProlog

Checking membership, concatenation,reverse,max/minoflist.

Module6:Pattern matching and symbolic reasoning

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

Module7:Expert system simulation(Miniproject)

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

Textbook:

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

Course Name: Digital Logic and Computer Organization Lab Course
Code: CS293
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:

- o

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

Course Outcomes (COs):

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

CO1	Design and simulate basic logic gates and circuits using Boolean algebra and Karnaugh Maps.
CO2	Implement and verify combinational circuits like multiplexers, encoders, adders using ICs/HDL
CO3	Design sequential circuits (flip-flops, counters, registers) and analyze timing diagrams.
CO4	Model and simulate arithmetic operations using HDL or logic kits.
CO5	Simulate memory structures and demonstrate instruction execution using RTL/HDL.

Course Content

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

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

Tools and Resources:

Software: Logisim, Multisim, ModelSim, Xilinx Vivado / ISE, Quartus
Hardware Kits: Digital Trainer Kit, ICs (74xx series), LEDs, switches, Breadboards
Languages: Verilog/VHDL (optional for advanced simulation)

Textbooks:

1. Digital Logic and Computer Design by M. Morris Mano, Pearson Education, 1st Edition

2. Computer Organization and Architecture: Designing for Performance by William Stallings, Pearson Education, 10th Edition

Reference Books:

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

Course Name: Engineering chemistry lab Paper
Code: CH191
Contact Hours: (L:T:P) 0:0:2
Total Contact Hours: 24
Credit: 1

Course Objective

- Study the basic principles of pH meter and conductivity meter for different applications

- nalysis of water for its various parameters & its significance in industries
- Learn to synthesis Polymeric materials and drugs
- Study the various reactions in homogeneous and heterogeneous medium

Course Outcome

CH191.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CH191.2: 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
CH191.3: Able to analyse different parameters of water considering environmental issues
CH191.4: Able to synthesize drug and sustainable polymer materials.
CH191.5: Capable to design innovative experiments applying the fundamentals of modern chemistry

CO-PO Mapping

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

COURSE CONTENT

1. Determination of the concentration of the electrolyte through conductance measurement.
2. Determination of water quality measurement techniques.
3. Determination of the concentration of the electrolyte through pH measurement.
4. Estimation of Cu in brass
5. Estimation of Fe_2O_3 in Cement
6. Isolation of graphene from dead dry batteries and their use for temporary soldering.

7. Synth
esis of Silver Nanoparticles doped organic thin film for organic transistors.
8. Estimation of corrosion in a given sample metal.
9. Preparation of Si-nano crystals for future memory devices.
10. Green Synthesis of ZnO based Polymer Nano composites.
11. Synthesis of polymers for electrical devices and PCBs.
12. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
13. Drug design and synthesis
14. Rheological properties of the Newtonian fluids
15. Innovative Experiments

Course Name: Idea Lab Workshop

Code: ME293
Contact Hours: (L:T:P) 0:0:3
Total Contact Hours: 24
Credit: 1.5

Course Objectives:
1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.

2. Learn use ful mechanical and electronic fabrication nprocesses.

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

Course Contents:

1	Electronic component familiarisation ,Understanding electronic system design flow .Schematic design and PCB layout and Gerbercreationusing Eagle CAD .Documentation using Doxygen, Google Docs, Overleaf. Version controltools-GITandGitHub. Basic 2D and 3Ddesigning using CAD tools such as Free CAD, Sketchup,PrusaSlicer,FlatCAM,Inkspace,OpenBSPandVer	Introduction to basic handtools-Tape measure,combination square,Vernier calliper, hammers, fasteners, wrenches, pliers, saws, tube cutter,chisels, vice and clamps, tapping and threading.Adhesives Introduction to Power tools :Power saws ,bandsaw ,jigsaw, angle grinder ,belts and er,bench grinder ,rotary tools. Various types of drill bits

	iCUT	
2	Familiarisation and use ofbasic measurement instruments-DSO including various triggering modes, DSO probes, DMM,LCR bridge,Signal and function generator. Logic analyser andMSO.Bench power supply(with 4-wireoutput) Circuit prototyping using (a) breadboard ,(b)Zero PCB(c)‘Manhattan’styleand (d)customPCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab .Soldering using solder ingiron/station.Soldering using atemperature controlled reflow oven .Automated circuit assembly and soldering using pick and place machines	Mechanical cutting processes - 3-axisCNC routing, basicturning, milling,drilling and grinding operations, Lasercutting,Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboarda Box
3	Electroniccircuitbuildingblocksincluding common sensors. Arduinoand Raspberry Pi programming anduse.DigitalInputandoutput. Measuring time and events. PWM.Serialcommunication.Analoginput.Interruptsprogramming.PowerSupplydesign(LinearandSwitchingtypes), Wireless power supply, USBPD, Solar panels, Battery types andcharging	3Dprintingandprototypingtechnology – 3D printing using FDM,SLS and SLA. Basics of 3D scanning,pointclouddatagenerationforreverseengineering. Prototyping using subtractive cuttingprocesses. 2D and 3D Structures forprototype building using Laser cutterandCNC routers. BasicsofIPRandpatents;Accessing andutilizingpatentinformationinIDEALab
4	Discussion and implementation of a mini project.	
5	Documentation of the mini project (Reportandvideo).	

LaboratoryActivities:

Sl. No	ListofLabactivitiesandexperiments
1	Schematic and PCB layout design of a suitable circuit, fabrication and test ofthe 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 FD MorSLAprinter
4	2D profile cutting of press fit box/casing in acrylic (3 or 6 mthickness)/cardboard,MDF (2mm)boardusinglaser cutter& engraver
5	D profile cutting on ply wood/MDF(6-12mm)forpressfitdesigns.

6	Familiarity and use of welding equipment.
7	Familiarity and use of normal and wood lathe.
8	Embedded programming using Arduinoand /or RaspberryPi.
9	Design and implementation of a capstone project involving embedded hardwares of twareand machined or 3Dprinted enclosure

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	CourseCode	Course Title	Hoursperweek				Credits
		A. THEORY			L	T	P	Total	
1	ENGG	Major	IOT301	Cryptography and Cyber Security	3	0	0	3	3
2	ENGG	Major	IOT302	Computer Architecture & Organization	3	0	0	3	3
3	ENGG	Major	IOT303	Design & Analysis of Algorithm	3	0	0	3	3
4	ENGG	Minor	CS(IOT)304	Database Management System	3	0	0	3	3
5	ENGG	Minor	IT(IOT)301	Probability and Statistics	3	0	0	3	3
		B. PRACTICAL							
1	ENGG	Minor	IOT391	Cryptography and Cyber Security Lab	0	0	3	3	1
2	ENGG	Major	IOT392	Computer Architecture & Organization lab	0	0	3	3	1.5
3	ENGG	Major	IOT393	Design & Analysis of Algorithm	0	0	3	3	1.5
4	ENGG	Major	CS(IOT)394	Database Management System Lab	0	0	3	3	1.5
5	ENGG	Major	IOT395	Python Programming Lab		0	3	3	1.5
		TOTALCREDIT							22

THEORY

SYLLABUS
Semester III

Course Name: Cryptography and Cyber Security

Paper Code: IOT 301

Contact (Periods/Week): 3L/Week
Total Contact Hours: 36, Credit : 3

COURSE OBJECTIVES:

1. Learn to analyze the security of in-built cryptosystems.
2. Know the fundamental mathematical concepts related to security.
3. Develop cryptographic algorithms for information security.
4. Comprehend the various types of data integrity and authentication schemes
5. Understand cybercrimes and cyber security.

COURSE OUTCOMES:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3: Apply the different cryptographic operations of public key cryptography
CO4: Apply the various Authentication schemes to simulate different applications.
CO5: Understand various cyber crimes and cyber security

CO-PO-PSO 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	2	2	-	-	-	1	-	1	2	2	3
CO2	3	3	3	3	3	-	-	-	2	-	1	2	3	3
CO3	3	3	3	3	3	-	-	-	2	-	1	3	3	3
CO4	3	3	3	3	3	-	-	-	2	-	1	3	3	3
CO5	3	2	3	2	3	-	-	-	3	-	1	3	3	2
	3	2.6	2.6	2.6	2.8	-	-	-	2	-	1.2	2.8	2.8	2.8

UNIT I : INTRODUCTION TO SECURITY 7
Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations

of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II :SYMMETRIC CIPHERS 7

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and
matrices – Group, Rings, Fields, Finite Fields
SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY 7

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing –Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm
ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 7

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos.
MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY 8

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods –Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCES

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

Course Name: Computer Architecture and Organization
Course Code: IOT 302
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 36; Credit: 3

Prerequisite: Digital Electronics

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

IOT 302.1 Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and apply this knowledge in designing solutions for real life engineering problems.

IOT 302.2 Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline hazards detection and prevention and use this knowledge for designing and implementing mathematical and engineering problems leading to lifelong learning.

IOT 302.3 Identify the concept of Instruction-Level Parallelism to solve engineering problems.

IOT 302.4 Illustrate and compare the concept of Multiprocessor architecture and parallel architecture and apply this knowledge for developing an approach by means of existing and new methods as a teamwork.

IOT 302.5 Understand the concept of message passing architecture and interconnection network and design an optimized model for building a new solution as a professional engineering practice as a team.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
IOT 302.1	3	3	3	2	-	-	-	-	-	-	-
IOT 302.2	3	3	3	3	-	-	-	-	-	-	3
IOT 302.3	2	2	2	3	-	-	-	-	-	-	-
IOT 302.4	3	3	3	3	-	-	-	-	-	-	-
IOT 302.5	3	3	3	3	-	-	-	-	-	-	-

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
IOT 302.1	3	3	3
IOT 302.2	3	3	3
IOT 302.3	3	3	3
IOT 302.4	3	3	3
IOT 302.5	3	3	3

Course Contents:

Module 1 8L

Introduction to CPU and concepts of ALU, Instruction format and instruction Cycle. Addressing Modes Fixed- point multiplication -Booth's algorithm. , Fixed-point division - Restoring and non-restoring algorithms, Floating-point number representation-IEEE754 format and Floating-point arithmetic operation.

Module 2 7L

Introduction to basic computer architecture, Stored Program Concepts: Von Neumann & Harvard Architecture, RISC VS CISC, Amdahl law , Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. Micro programmed and hardwired control unit

Module 3 8L

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards Pipeline vs. Parallelism, Levels of parallelism , Instruction- Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures , Array and Vector Processors

Module 4 9L

Introduction to memory-RAM and ROM , Register transfer, memory transfer, Tri-state bus buffer, Memory Hierarchy: Secondary memory , Main Memory , Cache Memory , Mapping Technique in cache memory: Direct, Full Associative and Set Associative , Performance Implementation in Cache Memory , Virtual memory Concepts , page replacement policies .

Module 5 4L

Multiprocessor architecture: taxonomy of parallel architectures; Flynn Classification , Centralized and Shared- memory architecture: synchronization , Interconnection Network

(Omega, Baseline, Butterfly, Crossbar) .

Text Books:
1. Advanced Computer Architecture Parallelism Scalability Programmabilit y, Tata McGraw-Hill Education
Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10:0-07-053070-X
2. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH

Reference Books:
1. Patterson D. A. and Hennessy, J. L.—Computer architecture a quantitative approach‖, 2nd ed. Morgan Kaufman, 1996
2. Hayes J. P., —Computer Architecture &amp; Organization, Mc Graw Hill
3. Siegel, H. J.—InterconnectionNetworkforLargeScaleparallelProcessing‖,2nd Ed .Mc Graw Hill,1990
4. Design and Analysis of Parallel Algorithm-Schism G. Akl

Course Name: Design & Analysis of Algorithm
Course Code: IOT 301
Contact: 3:1:0; Total Contact Hours: 36L; Credits: 3

Prerequisites: To know data-structure and basic programming ability

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

IOT 301.1. Understand and illustrate the concepts of time and space complexity, worst case, average case
and best-case complexities and the asymptotic notation.
IOT 301.2. Analyze and apply the design principles and concepts to various basic algorithm design viz.
dynamic programming, greedy methods etc.
IOT 301.3 Understand and analyze various string matching and graph algorithms.
IOT 301.4. Understand, illustrate and analyze the different complexity classes
IOT 301.5. Discuss, implement and analyze, verify the efficiency of the randomized and approximation algorithms.

CO-PO MAPPING

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
IOT 301.1	2	2	2	2	-	-	-	-	-	-	2
IOT 301.1	3	3	3	3	-	-	-	-	-	-	2
IOT 301.1	3	3	3	3	-	-	-	-	-	-	2
IOT 301.1	3	3	3	3	-	-	-	-	-	-	2
IOT 301.1	3	3	3	3	-	-	-	-	-	-	2

CO-PSO MAPPING

COs	PSO1	PSO2	PSO3
IOT 301.1	3	3	3
IOT 301.1	3	3	3
IOT 301.1	3	3	3
IOT 301.1	3	3	3
IOT 301.1	3	3	3

Course Content:

Module-1 4L

Algorithm Development & Complexity Analysis: 4L Stages of algorithm development for solving a problem: Describing the problem, identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm. Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem (Statement Only).

Module-2 14L

Algorithm Design Techniques Brute force techniques – Traveling Salesman Problem, Divide and Conquer -

Matrix multiplication: Strassen algorithm, Greedy techniques - Fractional Knapsack problem, Job Sequencing with Deadline, Graph Coloring, Finding Minimum Cost Spanning Tree, Dynamic programming

- O/1 Knapsack problem, Matrix chain multiplication, Travelling Salesman Problem, Backtracking-N Queens Problem, Knights Tour on Chess Board.

Module-3 3L

String matching problem: Different techniques – Naive algorithm, string matching using finite automata, and

Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Module-4 5L

Graph Algorithms Single Source Shortest Path –Dijkstra Algorithm, All pair shortest path – Floyd-Warshall

Algorithm. Network Flows, Maximum Flows – Ford-Fulkerson Algorithm, Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm.

Module-5 5L

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

Module-6 5L

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

Textbook:

1. "Introduction to Algorithms" by Cormen,Leiserson, Rivest,Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by
Kleinberg and Tardos**.**
3. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi Reference
Books:
4. Design Analysis and Algorithms ‖ by Hari Mohan Pandey.

Course Name : Database Management Systems
Course Code: CS(IOT)304
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 36; Credit: 3

Prerequisite:

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

Course Outcome(s):

On completion of the course students will be able to:

CO1 To understand the basic concepts and utility of Database management system
CO2 To Design an Entity Relationship (E-R) Diagram and relational model for an application.
CO3: To analyze and create the relational database based on normalization
CO4: To determine whether the transaction satisfies the ACID properties.
CO5: To implement and maintain the database of an organization

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

Module I 9L

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Module II 13L

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS -

MYSQL, ORACLE, DB2, SQL server.
Relational database design: Domain and data dependency,
Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.
Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Module III **3L**

Storage strategies: Indices, B-trees, hashing.

Module IV **5L**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi- version and optimistic Concurrency Control schemes, Database recovery.

Module V **3L**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Module VI **3L**

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text book and Reference books:

1. "Database System Concepts" , 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)
4. "Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S.Navathe,
5. Pearson Education "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

PRACTICAL

SYLLABUS
Semester III

Course Name : CRYPTOGRAPHY AND CYBER SECURITY LABORATORY
Course Code : IOT391
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1

COURSE OBJECTIVES:

1. Learn different cipher techniques.
2. Implement the algorithms DES, AES, RSA and Diffie-Hellman.
3. Implement hashing techniques such as SHA-1, MD-5.
4. Develop a digital signature scheme

COURSE OUTCOMES:

CO1: Develop a code for classical encryption techniques.
CO2: Build a symmetric and asymmetric algorithms.
CO3: Construct a code for various Authentication schemes.
CO4: Apply the principles of digital signature

CO-PO-PSO 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	2	2	-	-	-	1	-	1	2	2	3
CO2	3	3	3	3	3	-	-	-	2	-	1	2	3	3
CO3	3	3	3	3	3	-	-	-	2	-	1	3	3	3
CO4	3	3	3	3	3	-	-	-	2	-	1	3	3	3
	3	2.6	2.6	2.6	2.8	-	-	-	2	-	1.2	2.8	2.8	2.8

PRACTICAL EXERCISES:

1. Write a program to implement the following cipher techniques to perform encryption and decryption

i. Caesar Cipher
ii. Playfair Cipher
iii. Hill Cipher

2. Write a program to implement the following transposition techniques

(i) Rail fence technique –Row major transformation
(ii) Rail fence technique - Column major transformation
3. Write a program to implement DES algorithm
4. Write a program to implement AES algorithm
5. Write a program to implement RSA Encryption algorithm
6. Write a program to implement the Diffie-Hellman Key Exchange mechanism. Consider one
of the parties as Alice and the other party as bob.
7. Write a program to calculate the message digest of a text using the SHA-1 algorithm.
8. Write a program to calculate the message digest of a text using the MD-5 algorithm.
9. Write a program to implement digital signature standard

Course Name: Computer Architecture and Organization Lab
Course Code: IOT 392
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5

Prerequisites:
Knowledge of designing different circuits in Computer Organization Lab

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

CO1 Illustrate and use proper syntax in appropriate platforms for developing programs to solve problems related to Mathematics and Engineering fields leading to lifelong learning.

CO2 Apply the knowledge of algorithms in the computational area to efficient programming codes to design the problem using modern tools for solving complex engineering problems.

CO3 Outline different types of digital electronic circuits such as adder, subtract or, encoder decoder, multiplexer, demultiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit and optimize using various mapping and mathematical methods for solving the problem as a professional engineering practice as a team.

CO4 Apply the knowledge of digital electronic circuits to design memory and ALU and analyze the same to solve engineering-related computational problems as a team.

CO5 Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it to validate professional ethics and responsibilities and norms of the engineering practice.

CO-PO MAPPING

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2		2
CO4	2	2	2
CO5	2	2	2

List of Experiment:

1. Implement different types of Basic gates and simulate for truth table verification.
2. Implement half adder circuit and simulate for truth table verification.
3. Implement full adder circuit and simulate for truth table verification.
4. Implement half subtractor circuit and simulate for truth table verification.
5. Implement a full subtractor circuit and simulate for truth table verification.
6. Implement Multiplexer, De-Multiplexer circuit and simulate for truth table verification.
7. Implement Encoder, Decoder circuit and simulate for truth table verification.
8. Implement different types of flip flop and simulate for truth table verification.
9. Implement different types of parallel circuits (SISO, SIPO, PISO, PIPO) and simulate the result.
10. Implement ALU and simulate the result.
11. Implement a RAM chip and simulate the result.
12. Innovative Experiments

Database Management System Lab
Code: CS(IOT)394
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5
Contacts: 3P

Course Outcome(s):

On completion of the course students will be able to

CO1:Understand the database management system and data base language

CO2:Understand and apply the SQL queries related to management of data and transaction processing.

CO3:Explain about query processing techniques involved in query optimization

CO4:Understand PL/SQL programming,the concept of Cursor Management, Error Handling, Package and Triggers

CO5: Design and build the commercial data base systems.

CO-PO MAPPING

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

Laboratory Experiments:

Structured Query Language

1. Creating Database

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

2. Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

3. Retrieving Data from a Database

- The SELECT statement
- Using the WHERE clause

- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause
- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

4. Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Course Name: Python Programming Lab
Course Code: IOT395
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5

CO-PO MAPPING

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

CO-PSO MAPPING

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Introduction History, Features, Setting up path, Working with Python, Basic Syntax, Variable andData Types, Operator
Conditional Statements
If, If- else, Nested if-else, Looping, For, While, Nested loops Control Statements
Break, Continue,Pass String Manipulation
Accessing Strings, Basic Operations, String slices, Function and Methods Lists
Introduction, Accessing list, Operations, Working with lists, Function and Methods Tuple
Introduction, Accessing tuples, Operations, Working, Functions andMethods Dictionaries
Introduction, Accessing values in dictionaries, Working with dictionaries, Properties Functions
Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables Modules
Importing module, Math module, Random module, Packages, Composition,
Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions
Exception Handling
Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

2nd Year4th Semester

Sl. No.	Broad Category	Category	CourseCode	Course Title	Hoursperweek				Credits
A.THEORY					L	T	P	Total	
1	ENGG	Major	IOT401	Machine Learning	3	1	0	4	4
2	ENGG	Major	IOT402	Data Communication and Network	3	0	0	3	3
3	ENGG	Major	IOT403	System Security/Ethical Hacking	3	0	0	3	3
4	HUM	Major	IOT404	Operating System	3	0	0	3	3
5	SCI	Minor	M(IOT)401	Pattern Recognition	3	0	0	0	3
B. PRACTICAL									
1	ENGG	Major	IOT491	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	PRJ	IOT493	Android Application Development/Project	0	0	3	3	1.5
3	ENGG	Major	IOT492	Data Communication and Network lab	0	0	3	3	1.5
4	ENGG	Minor	IOT494	Operating System Lab	0	0	3	3	1.5
		TOTALCREDIT							22

THEORY

SYLLABUS
Semester IV

Course Name: Machine Learning
Course Code: IOT 401
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 36; Credit: 3

Prerequisite:

1. Basic programming skills, Algorithm design.

2. Probability, Axioms of Probability, Conditional Probability, Bernoulli Distribution, Binomial Distribution, Multinomial Distribution, Uniform Distribution, Normal (Gaussian) Distribution, Chi-Square Distribution, t Distribution, F Distribution. Probability Distribution and Density Functions, Joint Distribution and Density Functions, Conditional Distributions, Bayes' Rule, Expectation, Variance, Weak Law of Large Numbers.

3. LinearAlgebra; Convex Optimization; Statistics; Calculus

Prerequisite:
Course Outcome(s)
CO1:Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CO2:Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
CO3: Understand how to evaluate models generated from data.
CO4:Apply the algorithms to problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

CO-PO MAPPING

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

Module1: [8L]

Supervised Learning (Regression/Classification)
• Basic methods: Distance-based methods, NearestNeighbours, Decision Trees, Naive Bayes
• Linear models: Linear Regression, Logistic Regression, Generalized Linear Models
• Support Vector Machines, Nonlinearity and Kernel Methods
• Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Module 2: [6L]

Unsupervised Learning • Clustering: K-means/Kernel K-means • Dimensionality Reduction: PCA and kernel PCA • Matrix Factorization and Matrix Completion • Generative Models (mixture model sand latent factor models) R23B.TechCSE

Module 3: [4L]

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

Module 4: [7L]

Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Module 5: [7L]

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Module6: [4L]

Recent trends in various learning techniques of machine learning and classification methods.

Text Book 1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MITPress,2012

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer

References: 1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

2. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

Course Name: Data Communication and Networks
Course Code: IOT 401
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 36; Credit: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and ComputerArchitecture.

2. Also require a little bit of programming languages concepts like C,Java**.**

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand basics of computer network and different architecture and topologies of computer network and analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
CO2	Understand/analyze different protocols of the data link layer and apply them to solve engineering problems.
CO3	Understand/analyze different protocols of Network and Transport Layer and apply them to solve engineering problems.
CO4	Understand/analyze different protocols of session and application layer and apply them to solve engineering problems.
CO5	Develop, Analyze, specify and design the topological and routing strategies using socket programming.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

DATA COMMUNICATION AND NETWORKS

Basic concepts of computer networks, Layered architecture and comparison between ISO/OSI, TCP/IP layered models. Significance of Datalink layer and protocols. Network layer functionalities, classful, classless IP addressing, address allocation and role of forwarding module in forwarding the packet using routing table. Roles played by IP, ARP, RARP, ICMP& IGMP protocols in network layer. Inter-domain and intra-domain routing algorithms for routing tables. Importance of transport layer in achieving process-to-process communication. Insight of connection oriented protocol TCP and connectionless protocol UDP. Features of TCP in achieving flow control, error control and congestion control. Requirement of different timers in TCP. Drawbacks of IPv4 addressing and new IP addressing scheme IPv6. Migrating from IPv4 to IPv6. Introduction to application layer, a client/server application program and a case study. Client-server application program-Dynamic Host Configuration Protocol (DHCP).

References:

1. Behrouz A. Forouzan, *TCP/IP Protocol Suite*, 4th Edition, Tata McGraw Hill, 2010.
2. Tannenbaum, A.S, *Computer Networks*, *5th Edition*, Prentice Hall of India EE Edition, 2011.
3. Behrouz A. Forouzan, *Data Communications and Networking*, 5th Edition, Tata McGraw Hill, 2013.
4. Leon Garcia and Widjala, *Communication Networks*, 5th Edition, Tata McGraw Hill, 2017.
5. Bhawneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2019.

Course Name : System Security/Ethical Hacking
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 36; Credit:3

Module	Contents	Hrs
1	**Module: Introduction to ethical Hacking:** What is ethical hacking? Types of hacking, advantages, disadvantages and purpose of hacking, Types of hackers, Code of ethics, Types of attacks and attack vector types, Prevention from hackers, The Indian IT Act 2000 and Amendments to the Indian IT Act(2008) ,Phases of hacking.	04
2	**Module:Footprinting and Reconnaissance.** What is footprinting? Active and passive footprinting, purposeof footprinting, objectives of footprinting, footprinting threats, Types of footprinting, footprinting countermeasures.	05
3	**Module: Scanning networks, Enumeration and sniffing: Scanning networks:** Network scanning and its types, objectives of network scanning, scanning live systems, scanning techniques-TCP Connect / Full Open Scan, Types of Stealth scans, port scanning countermeasures, IDS evasion techniques, Banner grabbing and its tools, vulnerability scanning, proxy servers, anonymizers, IP spoofing and its countermeasures. **Enumeration and Sniffing:** What is Enumeration? Enumeration techniques, Enumeration types,Enumeration countermeasures, what is sniffing? Wiretrapping and its types, packet sniffing, sniffing threats, how sniffers work?, sniffing methods-ARP spoofing and MAC flooding, active and passive sniffing, types of sniffing attacks, sniffing countermeasures,sniffing detection techniques	08
4	**Module: Trojans and other Attacks:** Worms, viruses, Trojans, Types of worms, viruses and worms, Preventing malware attacks, types of attacks: (DoS / DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs andBOTNETs, Steganography - text, image and audio and video, types of Social Engineering: Physical social engineering, Remotesocial engineering and hybrid social engineering.	08

5	**Module: Hacking web servers, web applications and sql injection:** **Session hijacking:** What is session hijacking? , why session hijacking is successful?session hijacking techniques, session hijacking process, Types of session hijacking, session hijacking countermeasures: protecting and preventing, **Hacking web servers and web applications:** Causes of webservers being compromised, web server attacks, stages of web server attacks, defending against web server attacks, web application components, its working, architecture, web server attack vectors, web application threats and counter	6
	measures **SQL Injection:** What is SQL injection, SQL injection threats, SQL injection attacks, SQL injection detection, Types of SQL injection, SQL injection methodology, SQL injection prevention and countermeasures.	
6	**Module: Wireless network hacking, cloud computing security, cryptography, Pen testing::** Types of wirelessArchitecture, wireless encryption techniques-WEP and WPA, breaking WEP/WPA and defending WPA encryption, wireless Sniffing, Characteristics, types of cloud computing services, models and benefits, threats and attacks, cryptography and its objectives, cryptography types, cryptography attacks, whatis Pen Testing, need for pen testing, types and techniques of pen testing, phases of pen testing.	07

Books & References

1. Matt Walker, All-In-One-CEH-Certified-Ethical-Hacker-Exam-Guide.
2. Tutorials Point Professionals, Ethical Hacking by Tutorials Point.
3. Kimberly Graves(26th-April-2010), "CEH Certified Ethical Hacker Study Guide" 1st Edition, ISBN-13: 978-0470525203, ISBN-10:0470525207, Sybex- Wiley Publishing.
4. Sean-Philip Oriyano, Sybex, Certified Ethical Hacker Study Guide v9, Study Guide Edition, 2016.

Course Name : Operating Systems
Course Code: IOT 404
Contact (L: T: P): 2 : 0 : 0; Total Contact Hours: 36; Credit: 3

Prerequisites:

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

Course Outcomes (COs):

After attending the course students should be able to

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

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3							3
CO2	3	3	3	3							3

CO3	3	3	3	3							3
CO4	3	3	3	3							3
CO5	3	3	3	3							3

CO-PSO MAPPING

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Module I **3L**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Module II **10L**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre- emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module III **6L**

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module IV **6L**

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module V **5L**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging,

Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms:
Optimal, First in First Out (FIFO), Second Chance (SC),
Not recently used (NRU) and Least Recently used (LRU).

Module VI **6L**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms
File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.
Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-

SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

COURSE NAME : Pattern Recognition
COURSE CODE : M(IOT)401
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 40; Credit: 3

Course Objectives:

After completing this course, the students should be able to:
1. Understand basic concepts in pattern recognition
2. Gain knowledge about state-of-the-art algorithms used in pattern recognition research
3. Understand pattern recognition theories, such as Bayes classifier, Decision trees, SVM, linear discriminant analysis.
4. Apply pattern recognition techniques in practical problems.

Course Outcomes :

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

CO1	Acquire knowledge to interpret relevant information to design a simple pattern recognition system
CO2	Identify the strengths and weaknesses of different pattern classification techniques

CO3	Implement different pattern classifiers
CO4	Apply pattern recognition techniques to real-world problems
CO5	Evaluate the result from a simple pattern recognition system

COs-POs Mapping

Course	CO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
PEC-IT602D	PEC-IT602D.1	2	3	2								2
	PEC-IT602D.2	2	3	3								2
	PEC-IT602D.3	3				2				2		
	PEC-IT602D.4	3	3	3		2	2			2		1
	PEC-IT602D.5	2		3	2	2						1
												2
	PEC-IT602D											2

COs-PSOs Mapping

Course	CO's	PSO-1	PSO-2	PSO-3
PEC-IT602D	PEC-IT602D.1	3		
	PEC-IT602D.2		2	2
	PEC-IT602D.3	3	2	3
	PEC-IT602D.4	2	3	2
	PEC-IT602D.5	2	2	1
	PEC-IT602D			

Introduction [2L]
Basic idea of pattern recognition: Some basic definition, Types of learning, Few examples of pattern recognition techniques.

Bayesian Decision Theory [8L]
Classifiers, Discriminant functions, Decision surfaces, Normal density and decision functions, Discrete features

Parameter Estimation Methods [6L]
Maximum likelihood estimation, Gaussian mixture models, Expectation maximization method, Bayesian estimation

Hidden Markov Models for Sequential Pattern Classification [8L]
Discrete hidden Markov models, Continuous density hidden Markov models

Dimension Reduction Methods [3L]
Fisher discriminant analysis, Principal component analysis, Parzen-window methods, K-nearest neighbor method

Non-parametric techniques for density estimation [2L]
Density estimation techniques

Linear Discriminant Function Based Classifier [5L]
Perceptron, Support Vector Machines

Non-parametric Methods for Pattern Classification [4L]
Non-numeric data or nominal data, Decision trees

Unsupervised Learning and Clustering [2L]
Criterion functions for clustering, Algorithms for clustering : K-means, Hierarchical and other methods

Text Books and Reference Books:

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
McGraw Hill
4. V. S. Devi, M. N. Murti, Pattern Recognition, Universities Press (India) Pvt. Ltd.

LABORATORY

SYLLABUS

Semester IV

Course Code: Machine Learning Lab Course Code: IOT 491

Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5

- Write a python program to import and export data using Pandas library functions
- Demonstrate various data pre-processing techniques for a given dataset
- Implement Dimensionality reduction using Principle Component Analysis (PCA) method.
- Write a Python program to demonstrate various Data Visualization Techniques.
- Implement Simple and Multiple Linear Regression Models.
- Develop Logistic Regression Model for a given dataset.
- Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
- Implement Naïve Bayes Classification in Python 48 9 Build KNN Classification model for a given dataset.
- Build Artificial Neural Network model with back propagation on a given dataset.
- a) Implement Random forest ensemble method on a given dataset.
- b) Implement Boosting ensemble method on a given dataset.
- Write a python program to implement K-Means clustering Algorithm.

Course Name :Android Application Development/Project
Course Code : 493
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5

Pre-Requisite(s): – Advanced Programming and 24CYS203- Operating System
CoursCourse Objectives
1. ThiThis course covers the fundamentals of Android programming using the Android SDK.
2. To To provide and discuss various techniques and tools to develop & deploy Android Applications.
3. To To demonstrate various applications of Android programming and its practical implications

Pre-Requisite(s): 24CYS204– Advanced Programming and 24CYS203- Operating System
Course Objectives
1. This course covers the fundamentals of Android programming using the Android SDK.
2. To provide and discuss various techniques and tools to develop & deploy Android

Applications.
3. To demonstrate various applications of Android programming and its practical implications

Syllabus

Introduction to Android OS and App Development - Architecture, Types of Applications, Building an App, Understanding Activities, Activity Lifecycle, Managing State. Understanding various layouts and UI controls, Intents - Explicit, Implicit, Basic of Data Storage - SQLite, Shared Preferences. Understanding Broadcast receivers and Content Providers. Basic of Connecting Web APIs, Basic of Working in Background - Services, Async Tasks, GPS and GoogleMaps, Sensors.

Text Book(s)
1. Y. Karim, Embedded Android, O'Reilly Media, First Edition; 2013.
2. Michael Burton, Android Application Development for Dummies, Third Edition, Wiley; 2015.

Reference(s)
1. Pradeep Kothari, Android Application Development Black Book, Dreamtech Press; 2014

Course Name: Data Communication and Networking Lab
Course Code: IOT 491
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C,Java and UNIX or Linux environment.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To design and implement small size network and to understand various networking commands.
CO2	To provide the knowledge of various networking tools and their related concepts.
CO3	To understand various application layer protocols for its implementation inclient/server environment
CO4	Understand the TCP/IP configuration for Windows and Linux
CO5	Learn the major software and hardware technologies used on computer networks

CO-PO Mapping

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

Student should be able to configure peer-to-peer network. This will help to understand different issues involved in peer-to-peer network.
Apply computer engineering discipline specific knowledge to solve core computer engineering related problems.
Function effectively as a leader and team member in diverse/multi disciplinary teams.
Ability to install and configure TCP/IP protocol. Ability to configure peer □ network.

List of Experiments

1) Configure Peer-to-Peer Network at least three Host.
2) Create desired standard network cable including cross cable and test it by using cable tester
3) Connect computer using given topology with wired media.
4) Connect Computers Using Wireless Media
5) Write a C Program for CRC Error Detection
6) Create a Network Using Bluetooth. Setting up wireless network
7) Configure File Server. Configure client to file server and use file services
8) Configure static and dynamic IP addresses. Configure DHCP server
9) Run basic utilities and network commands: ipconfig, ping,tracert,netstat, path ping ,route.
10) Create two subnets and implement it with calculated subnet masking
11) Set access rights and security permissions for user.
12) Create IPv6 environment in a small network using simulator
13) Linux network configuration, measurement and analysis tool: Wireshark
14) Socket Programming: TCP and UDP, peer to peer applications
15) Client Server using RPC using threads or processes
16) Simulation of LAN and Wi-Fi

Reference Books :

1) “Data and Computer Communication” by William Stallings
2) “Data Communication and Networking” by Behrouz A Forouzan
3) “Internetworking with TCP/IP, Volume 1” by Douglas Comer
4) “Computer Networks 5th Edition” by Tanenbaum
5) “An Integrated Approach to Computer Networks” by Bhawneet Sidhu

Operating System Lab
Code: IOT 494
Contacts: 3P
Contact (L: T: P): 3 : 0 : 0; Total Contact Hours: 24; Credit: 1.5
Credit: 1.5

Prerequisites:

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

Course Outcomes (COs):

After attending the course students should be able to

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

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

1. Managing Unix/Linux Operating System [8P]: Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.
2. Process [4P]: starting new process, replacing a process image, duplicating aprocess image, waiting for a process, zombie process.
3. Signal [4P]: signal handling, sending signals, signal interface, signal sets.
4. Semaphore [6P]: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. POSIX Threads [6P]: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel) Inter-process communication [6P]: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Books:

2. Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPBPublications
3. Beej's Guide to UnixIPC
4. W. Richard Stevens, UNIX Network Programming, 2nd edition, PrenticeHall

3rd Year 5th Semester

Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
A.THEORY					L	T	P	Total	
1	ENGG	Major	IOT501	IoT Application and Design	3	0	0	3	3
2	ENGG	Major	IOT502	Secure Coding/ Malware Analysis	3	0	0	3	3
3	HUM	Minor	HU(IOT)503	Cyber Law and Ethics	3	0	0	3	3
4	ENGG	Minor	IT(IOT)501	User Interface Design/ Information and Coding Theory	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(IOT)501	Business Communication and Value Science	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	IOT591	IoT Application and Design Lab	0	0	3	3	1.5
2	ENGG	Major	IOT592	Malware Analysis Lab	0	0	3	3	1.5
3	ENGG	PRJ	IOT593	Project	0	0	3	3	1.5
4	Skill Enhancement Course	Internship	IOT581	Internship/Industrial Training	0	0	2	2	2
		TOTALCREDIT							20.5

THEORY

SYLLABUS

Semester V

Course Name: IoT Application and Design
Course Code: IOT501
Contact: 3L/Week
Credit Points: 3

Objective:

1. To understand the architecture and domain-specific application of IoT
2. To learn network function and communication protocols required for IoT application
3. To learn about the Raspberry PI platform, which is popular in IoT applications.
4. To gain a better understanding of how web-based services are implemented on IoT devices.
5. To learn IoT-enabled technologies and IoT platforms
6. To gain knowledge of the Python Scripting Language, which is widely used in IoT devices.

Module No. 1:

• Definition, Characteristics, and Features of IoT. □ IoT Ecosystem □ IoT Decision Framework

Module No. 2

• IoT Architecture, Applications, and Design □ Domain-specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health, and Lifestyle.

Module No. 3

• IoT & M2M □ Software-defined networks and network function virtualization □ Basics of IoT System Management

Module No. 4

• IoT Physical Devices & Endpoints □ Introduction to Raspberry PI and other IoT boards □ Different types of Interfaces (Serial, SPI, I2C).

Module No. 5

6□ Data Link Layer, Network Layer, and Session Layer. □ Corresponding Protocols (IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth) □ LoRa, MQTT Communication

Module No. 6

• Introduction to Cloud Storage models and communication APIs. □ Web server – Web server for IoT, Cloud for IoT □ Designing a RESTful web API

Module No. 7

• IoT Design Methodology and Case studies: Home Automation □ IoT-enabled technologies: Wireless sensor networks, Cloud computing, Big data analytics

Module No. 8

• Python program with Raspberry Pi. □ Relevant applications on Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib. □ Python web application framework.

Course Outcome:

Learners will be able to after completing this course to:

- Explain the meaning and use of the term "Internet of Things" in various situations.
- Prototype, program, and analyse data to build and test an IoT system.
- Describe the main components of an IoT system.

- In a typical IoT system, use cloud computing and data analytics.
- Distinguish between the layers of the IoT stack and be familiar with the essential technologies and protocols used at each tier.

Course Name: Secure Coding
Course Code: IOT 502A
Semester: 5th
Credits Points: 3
Contact Hour: 3/week

Course Objectives

- To understand the principles and importance of secure coding practices.
- To learn common software vulnerabilities and techniques to prevent them.
- To apply secure programming concepts in different programming languages.
- To introduce tools and frameworks for secure code analysis.
- To foster the habit of writing secure and robust code in real-world software projects.

Module 1: Introduction to Secure Coding (8 Hours)

Overview of software security and secure coding, Importance of secure software development lifecycle (SSDLC), Types of vulnerabilities: design flaws vs coding bugs. Secure coding principles and guidelines (e.g., CERT, CWE, OWASP), Risk assessment and threat modeling.

Module 2: Input and Memory-related Vulnerabilities (8 Hours)

Input validation failures, Buffer overflows, stack smashing, and format string issues. Integer overflows and underflows, Secure handling of arrays, pointers, and memory in C/C++, Case studies: Heartbleed, Morris Worm.

Module 3: Injection Attacks and Web Vulnerabilities (8 Hours)

SQL injection, Command injection, Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF), Directory traversal and path manipulation, Insecure deserialization and file inclusion vulnerabilities, ecure coding practices in web applications (JavaScript, PHP, Python).

Module 4: Secure Software Design and Development Practices (8 Hours)

Principle of Least Privilege, Defense in Depth, Error handling and exception management, Logging and auditing securely, Secure API usage and sandboxing, Secure coding standards in Java, Python, and embedded C.

Module 5: Tools and Techniques for Secure Coding (8 Hours)

Static and dynamic code analysis tools (e.g., SonarQube, Coverity), Secure code review techniques and checklists, Penetration testing basics for developers, Security testing and fuzzing tools, Real-world case studies and vulnerability reports.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand the principles and motivations behind secure coding practices.
CO2	Identify and describe common software vulnerabilities in various coding environments.
CO3	Apply secure programming techniques to mitigate known vulnerabilities.
CO4	Use industry tools to analyze, review, and test the security of software code.
CO5	Evaluate and implement secure software design strategies in real-world scenarios.

CO-PO Mapping

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

Course Name: Malware
Analysis Course Code:
IOT 502B *Semester:* 5th
Credits Points: 3
Contact Hour:
3/week

Course Objectives

- To introduce students to the types and behaviors of malware.
- To provide knowledge on static and dynamic malware analysis techniques.
- To familiarize students with tools used in reverse engineering and sandboxing.
- To understand the methodologies of detecting, analyzing, and mitigating malware.
- To study real-world malware case studies for practical exposure.

Module 1: Introduction to Malware (8 Hours)
Definition and history of malware, Types of malware: viruses, worms, Trojans, ransomware, spyware, adware, etc, Malware lifecycle and infection vectors, Motivations behind malware attacks, Overview of anti-malware strategies.

Module 2: Static Malware Analysis (8 Hours)
Introduction to static analysis, Tools for static analysis: strings, PEiD, Dependency Walker, Analyzing malware binaries without execution, Hashing and signature-based detection, Disassembly and reverse engineering basics.

Module 3: Dynamic Malware Analysis (8 Hours)
Introduction to dynamic analysis, Virtual machines and sandbox environments, Monitoring file

system, registry, and process behavior, Network behavior analysis, Dynamic analysis tools: Process Monitor, Wireshark, Regshot.

Module 4: Reverse Engineering and Anti-analysis Techniques (8 Hours)
Disassemblers and debuggers (IDA Pro, Ghidra, OllyDbg), Unpacking and decrypting malware, Anti-debugging, anti-VM, and code obfuscation techniques, Control flow graphs and binary instrumentation, Advanced unpacking techniques.

Module 5: Real-world Malware and Defense (8 Hours)
Case studies of notable malware (Stuxnet, WannaCry, Emotet, etc.), Behavioral and heuristic detection methods. Indicators of compromise (IOCs) and threat intelligence, Malware triage and reporting, Incident response and mitigation strategies.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand the fundamentals of malware, its types, and attack mechanisms.
CO2	Apply static and dynamic analysis techniques to analyze malware behavior.
CO3	Use reverse engineering tools and techniques to dissect malware.
CO4	Identify real-world malware threats and their countermeasures.
CO5	Develop incident response strategies based on malware indicators and intelligence.

CO-PO Mapping

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

Course Name: Cyber Law and Ethics Course Code: HU(IOT)503 Semester: 5th
Credits Points: 3
Contact Hour:
3/week

Course Objectives

- To introduce the fundamental concepts of cyber law, digital ethics, and IT regulations.
- To understand the legal frameworks governing cybercrime and electronic transactions.
- To explore ethical challenges in computing, privacy, and data protection.
- To examine national and international cyber laws and regulatory practices.
- To promote responsible digital behavior and understanding of cyber law implications.

Module 1: Introduction to Cyber Law and IT Act (8 Hours)

Need for cyber laws and scope, IT Act 2000 and amendments, Key definitions and legal recognition of electronic documents, Digital signature and e-governance, Cyber Regulations Appellate Tribunal.

Module 2: Cyber Crimes and Legal Framework (8 Hours)

Types of cyber crimes: hacking, phishing, identity theft, cyber terrorism, Investigation and adjudication of cyber-crimes, Offenses under the IT Act and IPC, Cybercrime reporting and enforcement agencies, Case laws on cybercrime in India.

Module 3: Privacy, Data Protection and Ethics (8 Hours)

Data protection principles and policies, Right to privacy and data breach consequences, Ethical issues in cyberspace: anonymity, surveillance, and censorship, Cyber ethics for developers and users, GDPR and data protection frameworks.

Module 4: Intellectual Property and Digital Rights (8 Hours)

Copyright, trademarks, and patents in cyberspace, Software licensing and open-source legal issues, Digital rights management and fair use, Domain name disputes and cybersquatting, WIPO and international treaties.

Module 5: Cyber Law Compliance and Governance (8 Hours)

Cybersecurity policy and IT compliance, Organizational responsibilities and risk management, Cyber forensics and incident handling, Cyber law in E-commerce and digital contracts, Emerging trends in cyber regulation and digital governance.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand the basics of cyber law and legal provisions under the IT Act.
CO2	Identify different types of cyber crimes and interpret legal implications.
CO3	Analyze ethical and privacy issues in the digital environment.
CO4	Explain digital intellectual property laws and rights management.
CO5	Apply legal and ethical practices in cybersecurity and cyber governance scenarios.

CO-PO Mapping

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

Course Name: User Interface Design

Course Code: IT(IOT)501A
Semester: 5th
Credit Points: 3
Contact Hour: 3/week

Course Objectives

- To introduce the principles of user interface design and human-computer interaction.
- To understand the process of designing user-friendly and accessible interfaces.
- To explore design guidelines, usability testing, and interaction models.
- To use prototyping tools and evaluate interface effectiveness.
- To design interfaces suitable for various devices including web and mobile platforms.

Module 1: Introduction to UI/UX Design (8 Hours)

Fundamentals of Human-Computer Interaction (HCI), Importance and principles of user interface design, User-centered design and usability goals, Types of interfaces: command-line, graphical, web, mobile, Design process and lifecycle.

Module 2: User Needs and Requirements (8 Hours)

Understanding users and their goals, Requirement gathering techniques: interviews, surveys, observations, Personas, scenarios, and use cases, Information architecture and task analysis, Cognitive models and mental models.

Module 3: Design Guidelines and Prototyping (8 Hours)

Heuristics and usability principles (e.g., Nielsen's heuristics), Wireframing and low/high-fidelity prototyping, Layout, navigation, and interaction design patterns, Design tools Figma, Adobe XD, Sketch, Case studies and design critiques.

Module 4: Evaluation and Usability Testing (8 Hours)

Usability testing methods: heuristic evaluation, cognitive walkthrough, User testing protocols and metrics, Accessibility evaluation (WCAG), Feedback gathering and iterative design, A/B testing and user feedback analysis.

Module 5: Advanced Topics in UI Design (8 Hours)

Responsive and adaptive design principles, Designing for mobile and touch interfaces, Voice and gesture-based interfaces, UI for embedded and IoT systems, Ethical considerations and future trends in UI design.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand the fundamental principles and components of user interface design.
CO2	Analyze user needs and apply design techniques based on user requirements.
CO3	Design and prototype user interfaces using appropriate tools and guidelines.
CO4	Evaluate user interfaces through usability testing and feedback analysis.
CO5	Implement responsive and accessible interfaces for various platforms and devices.

CO-PO Mapping

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

Course Name: Information and Coding Theory

Course Code: IT(IOT)501B
Semester: 5th
Credit Points: 3
Contact Hour: 3/week

Course Objectives

- - To introduce the basic concepts of information theory and entropy.
- - To explore source coding techniques including Huffman and Shannon-Fano coding.
- - To understand the fundamentals of error control coding and channel capacity.
- - To study linear block codes, cyclic codes, and convolutional codes.
- - To apply coding techniques in digital communication and storage systems.

Module 1: Introduction to Information Theory (8 Hours)

Information, entropy, mutual information, and conditional entropy, Properties of entropy, relative entropy, and Kullback-Leibler divergence, Source models and types of sources, Discrete memoryless sources and information measures, Source coding theorem.

Module 2: Source Coding Techniques (8 Hours)

Lossless data compression, Prefix codes, uniquely decodable codes, Huffman coding algorithm, Shannon-Fano coding, Arithmetic coding and run-length encoding.

Module 3: Noisy Channels and Channel Capacity (8 Hours)

Discrete memoryless channel (DMC), Channel transition probabilities and matrices, Channel capacity and Shannon's theorem, Symmetric and asymmetric channels, Joint and conditional probabilities in channels.

Module 4: Error Detection and Correction Codes (8 Hours)

Linear block codes and properties, Parity check matrix and syndrome decoding, Hamming codes and distance properties, Cyclic redundancy check (CRC), Introduction to BCH codes.

Module 5: Advanced Coding Techniques (8 Hours)

Convolutional codes and trellis diagrams, Viterbi decoding algorithm, Turbo codes and LDPC codes (concepts only), Applications in communication and storage systems, Case studies in digital systems using error control coding.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand fundamental concepts of entropy, mutual information, and source models.
CO2	Apply source coding techniques for data compression.
CO3	Analyze communication channels and compute channel capacity.
CO4	Design and evaluate error detection and correction codes.
CO5	Implement advanced coding schemes in digital communication and storage systems.

CO-PO Mapping

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

Course Name: Business Communication and Value Science

Course Code: HU(IOT)501

Semester: 5th

Credit Points: 3

Contact Hour: 3/week

Course Objectives

- To develop effective communication skills for academic and professional contexts.
- To enhance interpersonal skills and team collaboration.
- To instill ethical and value-based thinking in students.
- To apply business communication strategies in real-world situations.
- To promote critical thinking, emotional intelligence, and leadership values.

Module 1: Fundamentals of Communication (8 Hours)

Basics of communication: process, types, and barriers, Verbal and non-verbal communication, Listening skills and empathy in communication, Effective speaking and presentation techniques, Email etiquette and digital communication.

Module 2: Business Communication Essentials (8 Hours)

Business letters, reports, and proposals, Technical documentation and official correspondence, Meetings, minutes, and agenda writing, Interpersonal communication in corporate settings., Communication through visuals and graphics.

Module 3: Value Science and Ethical Communication (8 Hours)

Concept of values and value education, Workplace ethics, integrity, and professional conduct, Ethical decision making and case studies, Role of communication in resolving ethical dilemmas, Building trust and transparency.

Module 4: Interpersonal Skills and Teamwork (8 Hours)

Emotional intelligence and self-awareness, Conflict resolution and negotiation skills, Public speaking and group discussions, Building effective teams and leadership communication, Cultural sensitivity and global communication.

Module 5: Communication for Career Readiness (8 Hours)

Resume writing and cover letters, Mock interviews and HR communication, Networking and personal branding, Communication in entrepreneurship and startups, Real-world communication challenges and strategies.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Understand and apply the principles of effective communication.
CO2	Demonstrate business communication skills for formal and professional scenarios.
CO3	Analyze ethical issues and communicate with integrity and responsibility.
CO4	Collaborate effectively in teams using interpersonal and leadership skills.
CO5	Prepare and present oneself effectively for career opportunities using communication strategies.

CO-PO Mapping

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

PRACTICAL

SYLLABUS

Semester V

Lab Name: IoT Application and Design Lab
Lab Code: IOT591
Contact: 3P/Week
Semester: 5th
Credit Points: 1.5

Sl. No.	Laboratory Experiments
1	Study of IoT Physical Devices & Endpoints: Familiarization with different types of Sensors, Actuators, and Arduino
2	Study of Zigbee protocol using IoT devices
3	Study of Bluetooth protocol using IoT devices
4	Interfacing an IoT device with Smartphone: Using Bluetooth and Wi-Fi module
5	Study of the ESP232 and Node MCU
6	Study of M2M communication of multi-sensor data: Using Wired and Wireless media
7	Setting up Raspberry Pi: Installation of Operating System into the Raspberry Pi
8	Interfacing Sensor with Raspberry Pi
9	Interfacing Actuator with Raspberry Pi
10	To study data logging to cloud server of IoT data
11	Controlling actuators with the server using the Internet.
12	Study and implement Paho MQTT client in Python.
13	Study of Relevant applications on Python packages - JSON, XML, HTTP Lib, URL Lib,SMTP Lib
14	Study of Python web application framework
15	Making a Domain-specific IoT application

Course Name: Malware Analysis Lab
Course Code: IOT592
Semester: 5th
Credit Points: 1.5
Contact Hour: 3 (Lab)

Course Objectives

- - To provide practical exposure to tools and techniques used in malware analysis.
- - To analyze malware behavior using static and dynamic techniques.
- - To develop skills for reverse engineering and debugging malicious code.
- - To simulate malware analysis environments using sandboxes and VMs.
- - To handle real-world malware samples with ethical and safe lab practices.

Module 1: Introduction to Malware Analysis Lab Environment

Setting up virtual machines and isolated environments, - Installing malware analysis tools (PEStudio, Procmon, Wireshark, etc.), Basic Linux and Windows forensic commands, Understanding malware behavior and classifications through safe samples.

Module 2: Static Malware Analysis Techniques

Analyzing file headers and strings in executables, Identifying malware using hashing techniques (MD5, SHA256), Use of PEiD, Dependency Walker, and static analysis scripts, Detecting packed or obfuscated malware.

Module 3: Dynamic Malware Analysis Techniques

Running malware in sandbox (Cuckoo/Sandboxie), Monitoring system activity with Procmon and Process Explorer, Network traffic analysis using Wireshark, Registry and file system analysis during execution.

Module 4: Reverse Engineering Malware

Introduction to disassembly tools (IDA Free, Ghidra), Basic debugging using OllyDbg or x64dbg, Understanding malware logic and code flow, Modifying malware behavior in a controlled environment.

Module 5: Reporting and Case Studies

Documenting analysis findings and generating malware reports, Exploring real-world malware case studies (e.g., WannaCry, Emotet), Indicators of compromise (IOCs) and signature creation, Ethical guidelines and safety practices in malware handling.

Course Outcomes (COs)

CO No.	Course Outcome Description
CO1	Set up and manage malware analysis lab environments with proper safety protocols.
CO2	Perform static and dynamic analysis on malware samples using standard tools.
CO3	Apply reverse engineering techniques to understand malware behavior.
CO4	Analyze and document malware artifacts from real-world case studies.
CO5	Demonstrate ethical practices and critical thinking in malware analysis.

CO-PO Mapping

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

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
A. THEORY					L	T	P	Total	
1	ENGG	Major	IOT601	Cyber Forensics	3	0	0	3	3
2	ENGG	Major	IOT602	Cloud Computing	3	0	0	3	3
3	ENGG	Major	IOT603	Object Oriented Programming	3	0	0	3	3
4	ENGG	Major	IOT604	Formal Language and Automata Theory	3	0	0	3	3
5	ENGG	Major/Elective	IOT605A	Wireless Sensor Network Security	3	0	0	0	3
			IOT605B	Mobile and Wireless Security					
			IOT605C	Social Network Analysis					
B. PRACTICAL									
1	ENGG	Major	IOT691	Cyber Forensics Lab	0	0	3	3	1.5
2	ENGG	Major	IOT692	Cloud Computing Lab	0	0	3	3	1.5
3	ENGG	Major	IOT693	Object Oriented Prog. Lab	0	0	3	3	1.5
4	ENGG	PRJ	IOT694	Project				1.5	2
		TOTALCREDIT							21.5

Course Name: Cyber Forensics
Course Code: IOT601
Semester: 6th

Credits: 3
Contact Hours: 3 per week
Course Objectives

- To understand the fundamentals of cyber forensics and digital evidence handling.
- To gain knowledge about forensic tools, techniques, and procedures for evidence collection.
- To learn how to analyze cybercrimes and perform forensic investigations.
- To study the legal and ethical aspects of cyber forensics.
- To develop skills for network, mobile, and cloud forensics in IoT ecosystems.

Module 1: Introduction to Cyber Forensics (9 Hours)

Overview of Cyber Crime & Forensics, Types of Cyber Crimes: Hacking, Phishing, Identity Theft, Cyberstalking, Digital Evidence: Types, Characteristics, Collection Process Forensic Process Models: Identification, Preservation, Collection, Examination, Analysis, Reporting, Chain of Custody, Introduction to IoT Security Threats and Forensics

Module 2: File System and Data Recovery (9 Hours)

File Systems: FAT, NTFS, EXT, HFS+, Data Acquisition: Static and Live Acquisition Techniques, Imaging and Cloning of Drives, Data Recovery Techniques Steganography and Anti-Forensics Techniques, Evidence Preservation in IoT Environments

Module 3: Network and Cloud Forensics (9 Hours)

Network Forensics: Log Analysis, Packet Sniffing, Traffic Analysis, Email and Web Forensics
Cloud Forensics: Challenges, Evidence Collection from Cloud, Incident Response and Handling in Network Environments, Tools for Network and Cloud Forensics (e.g., Wireshark, FTK, EnCase)

Module 4: Mobile and IoT Forensics (9 Hours)

Mobile Forensics: SIM Card Analysis, Data Extraction, Forensics of IoT Devices and Embedded Systems, Challenges in IoT Device Forensics, Sensor Data Analysis and Artifact Extraction
Case Studies in Mobile and IoT Forensics

Module 5: Legal and Ethical Issues in Cyber Forensics (9 Hours)

Cyber Laws and IT Act 2000 (Amendments), Digital Evidence and Legal Admissibility, Privacy and Ethical Considerations, International Standards and Guidelines (ISO/IEC 27037, 27042, etc.), Case Studies on Cyber Crime Prosecution

Course Outcomes (COs)

CO No.	Statement
CO1	Understand the basic concepts and processes involved in cyber forensics and digital evidence handling.
CO2	Apply forensic tools and techniques for data acquisition, recovery, and analysis.
CO3	Perform network, cloud, and IoT forensics investigations.
CO4	Analyze mobile and embedded system data for forensic purposes.
CO5	Understand the legal framework and ethical issues related to cyber forensics.

CO-PO Mapping

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

Course Name: Cloud Computing
Course Code: IOT602
Semester: 6th

Credits: 3
Contact Hours: 3 per week

Course Objectives

- To understand the fundamentals of cloud computing and its service models.
- To learn about virtualization and resource management in cloud environments.
- To explore the architecture, deployment models, and technologies of cloud computing.
- To understand cloud security, privacy, and compliance issues.
- To introduce cloud programming models, cloud storage, and IoT-cloud integration.

Module 1: Introduction to Cloud Computing (9 Hours)

Overview of Cloud Computing, Evolution of Cloud Computing, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, Community, Benefits and Challenges of Cloud Computing, Cloud Computing and IoT Convergence

Module 2: Virtualization and Resource Management (9 Hours)

Virtualization Concepts: Hypervisors, Virtual Machines, Types of Virtualization: Server, Storage, Network, Resource Provisioning and Allocation, Virtualization for Cloud Computing, Containers and Microservices (Docker, Kubernetes), Energy-Efficient Resource Management

Module 3: Cloud Infrastructure and Services (9 Hours)

Cloud Architecture: Infrastructure, Platform, Software Layers, Data Centers and Cloud Storage Models, Service-Oriented Architecture (SOA) in Cloud, Cloud Providers: AWS, Azure, Google Cloud Overview, Load Balancing, Auto-Scaling, and Elasticity, Cloud APIs and Cloud Programming

Models

Module 4: Cloud Security and Compliance (9 Hours)
Security Issues in Cloud Computing, Data Privacy and Protection Mechanisms, Identity and Access Management (IAM), Compliance and Legal Issues in Cloud, Trust Management and Risk Assessment, IoT Data Security in Cloud Environments

Module 5: Emerging Trends and Case Studies (9 Hours)
Fog and Edge Computing, Serverless Computing, Cloud and IoT Integration for Smart Applications, Disaster Recovery and Business Continuity in Cloud, Case Studies of Cloud-based IoT Solutions, Future of Cloud Computing

Course Outcomes (COs)

CO No.	Statement
CO1	Understand the fundamental concepts, service models, and deployment models of cloud computing.
CO2	Apply virtualization techniques and manage cloud-based resources efficiently.
CO3	Utilize various cloud services and understand cloud infrastructure design.
CO4	Analyze security, privacy, and compliance aspects in cloud computing environments.
CO5	Explore advanced cloud computing trends and integrate cloud with IoT solutions.

CO-PO Mapping

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

Course Name: Object Oriented Programming
Course Code: IOT603
Semester: 6th
Contact Hour: 3

Course Outcomes: On completion of the course students will be able to

CO1. Specify simple abstract data types and design implementations, using abstraction functions to document them.

CO2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

CO3. Name and apply some common object-oriented design patterns and give examples of their use.

CO4. Design applications with an event-driven graphical user interface

Module 1 8L

Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant,abstraction function. Implementing operations, illustrated by the Text example.

Module 2 8L

Features of object-oriented programming. Encapsulation, object identity, polymorphism –but not inheritance.

Module 3 6L

Inheritance in object oriented design. Design patterns. Introduction and classification. The iterator pattern.

Module 4 6L

Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.

Module 4 6L

Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process

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

Text book and Reference books:
1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Name: Formal Language and Automata Theory
Course Code: IOT604
Semester: 6th
Credits: 3
Contact Hour: 3 per week

Objective:

1. Be able to construct finite state machines and the equivalent regular expressions.
2. Be able to prove the equivalence of languages described by finite state machines and regular expressions
3. Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
4. Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines

Module 1:
Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Module 2:
Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)

Module 3:
Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs

Module 4:
Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG

Module 5:
Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators

Module 6:
Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization

languages, reduction between languages and Rice s theorem, undecidable problems about languages

Course Outcomes:

On completion of the course students will be able to

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free language.
5. Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
6. Write the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

CO-PO Mapping Table

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	1	-
CO2	3	3	2	-	-	-	-	-	-	1	-
CO3	3	3	2	-	-	-	-	-	-	1	-
CO4	3	3	2	-	-	-	-	-	-	2	-
CO5	3	3	2	-	-	-	-	-	-	2	-
CO6	3	2	1	-	-	-	-	-	-	1	-
CO7	3	2	1	-	-	-	-	-	-	1	-

Course Name: Cyber Forensics
Course Code: IOT601
Semester: 6th
Credits: 3
Contact Hours: 3 per week
Course Objectives

- To understand the fundamentals of cyber forensics and digital evidence handling.
- To gain knowledge about forensic tools, techniques, and procedures for evidence collection.
- To learn how to analyze cybercrimes and perform forensic investigations.
- To study the legal and ethical aspects of cyber forensics.
- To develop skills for network, mobile, and cloud forensics in IoT ecosystems.

Module 1: Introduction to Cyber Forensics (9 Hours)

Overview of Cyber Crime & Forensics, Types of Cyber Crimes: Hacking, Phishing, Identity Theft, Cyberstalking, Digital Evidence: Types, Characteristics, Collection Process Forensic Process Models: Identification, Preservation, Collection, Examination, Analysis, Reporting, Chain of Custody, Introduction to IoT Security Threats and Forensics

Module 2: File System and Data Recovery (9 Hours)

File Systems: FAT, NTFS, EXT, HFS+, Data Acquisition: Static and Live Acquisition Techniques, Imaging and Cloning of Drives, Data Recovery Techniques Steganography and Anti-Forensics Techniques, Evidence Preservation in IoT Environments

Module 3: Network and Cloud Forensics (9 Hours)

Network Forensics: Log Analysis, Packet Sniffing, Traffic Analysis, Email and Web Forensics
Cloud Forensics: Challenges, Evidence Collection from Cloud, Incident Response and Handling in Network Environments, Tools for Network and Cloud Forensics (e.g., Wireshark, FTK, EnCase)

Module 4: Mobile and IoT Forensics (9 Hours)

Mobile Forensics: SIM Card Analysis, Data Extraction, Forensics of IoT Devices and Embedded Systems, Challenges in IoT Device Forensics, Sensor Data Analysis and Artifact Extraction
Case Studies in Mobile and IoT Forensics

Module 5: Legal and Ethical Issues in Cyber Forensics (9 Hours)

Cyber Laws and IT Act 2000 (Amendments), Digital Evidence and Legal Admissibility, Privacy and Ethical Considerations, International Standards and Guidelines (ISO/IEC 27037, 27042, etc.), Case Studies on Cyber Crime Prosecution

Course Outcomes (COs)

CO No.	Statement
CO1	Understand the basic concepts and processes involved in cyber forensics and digital evidence handling.
CO2	Apply forensic tools and techniques for data acquisition, recovery, and analysis.
CO3	Perform network, cloud, and IoT forensics investigations.
CO4	Analyze mobile and embedded system data for forensic purposes.
CO5	Understand the legal framework and ethical issues related to cyber forensics.

CO-PO Mapping

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

Course Name: Cloud Computing
Course Code:
IOT602
Semester: 6th
Credits: 3
Contact Hours: 3 per week

Course Objectives

- To understand the fundamentals of cloud computing and its service models.
- To learn about virtualization and resource management in cloud environments.
- To explore the architecture, deployment models, and technologies of cloud computing.
- To understand cloud security, privacy, and compliance issues.
- To introduce cloud programming models, cloud storage, and IoT-cloud integration.

Module 1: Introduction to Cloud Computing (9 Hours)

Overview of Cloud Computing, Evolution of Cloud Computing, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, Community, Benefits and Challenges of Cloud Computing, Cloud Computing and IoT Convergence

Module 2: Virtualization and Resource Management (9 Hours)

Virtualization Concepts: Hypervisors, Virtual Machines, Types of Virtualization: Server, Storage, Network, Resource Provisioning and Allocation, Virtualization for Cloud Computing, Containers and Microservices (Docker, Kubernetes), Energy-Efficient Resource Management

Module 3: Cloud Infrastructure and Services (9 Hours)

Cloud Architecture: Infrastructure, Platform, Software Layers, Data Centers and Cloud Storage Models, Service-Oriented Architecture (SOA) in Cloud, Cloud Providers: AWS, Azure, Google Cloud Overview, Load Balancing, Auto-Scaling, and Elasticity, Cloud APIs and Cloud Programming Models

Module 4: Cloud Security and Compliance (9 Hours)

Security Issues in Cloud Computing, Data Privacy and Protection Mechanisms, Identity and Access Management (IAM), Compliance and Legal Issues in Cloud, Trust Management and Risk Assessment, IoT Data Security in Cloud Environments

Module 5: Emerging Trends and Case Studies (9 Hours)

Fog and Edge Computing, Serverless Computing, Cloud and IoT Integration for Smart Applications, Disaster Recovery and Business Continuity in Cloud, Case Studies of Cloud-based IoT Solutions, Future of Cloud Computing

Course Outcomes (COs)

CO No.	Statement
CO1	Understand the fundamental concepts, service models, and deployment models of cloud computing.

CO2	Apply virtualization techniques and manage cloud-based resources efficiently.
CO3	Utilize various cloud services and understand cloud infrastructure design.
CO4	Analyze security, privacy, and compliance aspects in cloud computing environments.
CO5	Explore advanced cloud computing trends and integrate cloud with IoT solutions.

CO-PO Mapping

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

Course Name: Mobile and Wireless

Security Course Code: IOT605B
Semester: 6th
Credits: 3
Contact Hour: 3 per week

Course Objectives

- To provide students with an understanding of the security challenges and solutions in mobile and wireless communication systems.
- To introduce various mobile security mechanisms including authentication, encryption, and secure communication protocols.
- To analyze threats and vulnerabilities in wireless networks such as Wi-Fi, Bluetooth, and cellular systems.
- To understand secure mobile app development and mobile malware threats.
- To enable students to apply security practices in real-world wireless and mobile environments.

Module 1:
Introduction to Mobile and Wireless Security (9L)
Overview of mobile and wireless technologies, Security goals and challenges in mobile and wireless communication, Threat models and attack surfaces, Basic security concepts: confidentiality, integrity, availability, authentication, non-repudiation

Module 2:
Wireless Network Security (Wi-Fi, Bluetooth) (9L)
IEEE 802.11 security: WEP, WPA, WPA2, WPA3, Bluetooth security architecture and threats, Wireless intrusion detection and prevention, Case studies: Wi-Fi hacking tools and countermeasures

Module 3:
Cellular Network Security (9L)
GSM, UMTS, LTE, and 5G security architectures, SIM card security, IMSI catchers and mobile tracking, End-to-end encryption in cellular networks

Module 4:
Mobile Application Security (9L)

Secure coding practices for Android and iOS, Mobile app vulnerabilities and OWASP Mobile Top 10, Reverse engineering and tampering prevention, Security testing tools: static and dynamic analysis

Module 5:
Emerging Trends and Case Studies (9L)
Mobile payment systems and their security, IoT and mobile convergence: security implications Blockchain for mobile security, Case studies on recent attacks and mitigations in mobile/wireless environments.

Course Outcomes (COs)

CO1: Understand the fundamental concepts and challenges in mobile and wireless security.
CO2: Analyze threats and vulnerabilities in various wireless technologies.
CO3: Evaluate the security architectures of cellular and wireless networks.
CO4: Apply secure coding practices in mobile application development.
CO5: Explore and assess modern trends and solutions in mobile and wireless security.

CO-PO Mapping

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

Course Name: Social Network Analysis Course Code: IOT605C
Semester:6th
Credits:3
Contact Hours:3 per week

Course Objectives:

- To understand the structure and properties of complex networks.
- To model social networks mathematically and analyze their behavior.
- To learn various algorithms and tools for social network analysis.
- To explore community detection, influence propagation, and link prediction.
- To apply social network analysis techniques in real-world IoT-enabled systems.

Detailed Syllabus:
Module 1: Introduction to Social Network Analysis (9 Hours)

Basic concepts: Nodes, Edges, Graphs, Types of networks: Social, Biological, Information, Technological, Network representation: Matrices and Lists, Basic properties: Degree, Path, Diameter, Clustering Coefficient, Applications in IoT and Communication Networks

Module 2: Network Models (9 Hours)

Random Networks: Erdős–Rényi Model, Small-World Networks: Watts-Strogatz Model Scale-Free Networks: Barabási-Albert Model, Generative Models of Social Networks Graph Visualization

Techniques

Module 3: Centrality and Community Detection (9 Hours)

Node Centrality Measures: Degree, Betweenness, Closeness, Eigenvector Community Detection Algorithms:Girvan-Newman Algorithm, Modularity-based methods, Label Propagation, Role of Communities in IoT Systems

Module 4: Link Analysis and Mining (9 Hours)

PageRank and HITS Algorithms, Link Prediction Techniques, Influence Maximization, Network Robustness and Vulnerability, Privacy and Security in Social Networks

Module 5: Tools and Applications (9 Hours)

Tools: Gephi, NetworkX, SNAP, Social Network APIs (Facebook, Twitter), Case Studies:Epidemic Spread in IoT, Marketing and Recommendation Systems, Social Sensing in Smart Cities, Project-based Learning: Real-world Network Analysis.

Course Outcomes (COs):

CO	Statements
CO1	Understand fundamental concepts and metrics of social network analysis.
CO2	Model and simulate different types of networks using standard models.
CO3	Apply centrality measures and community detection algorithms.
CO4	Analyze real-world network data for link prediction and influence propagation.
CO5	Use software tools for visualization and analysis of social network data in IoT systems.

CO-PO Mapping:

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

Course Name: Cyber Forensics Lab
Course Code: IOT691
Semester: 6th
Credits: 1.5
Contact Hour: 3 per week

Course Objectives

1. To understand the fundamentals and scope of cyber forensics and its role in cybercrime investigation.
2. To gain hands-on experience in data recovery, evidence collection, and preservation techniques.
3. To apply forensic tools for analyzing digital evidence from various platforms.
4. To examine forensic procedures and legal considerations in cybercrime investigation.
5. To develop skills for writing professional forensic reports and presenting findings in legal scenarios.

Module 1:

Introduction to Cyber Forensics , Cybercrime Types , Forensics Lifecycle , Role of Cyber Forensics in Investigation, Legal Challenges.

Module 2:

File System Forensics, FAT, NTFS, EXT File System Analysis , Deleted File Recovery, Metadata Analysis.

Module 3:

Memory Forensics, RAM Acquisition , Volatility Framework , Malware Analysis

Basics. Module 4:

Network Forensics ,Packet Capture and Analysis, Email and Web Forensics ,Intrusion Detection

Logs. Module 5:

Mobile and Cloud Forensics, Android/iOS Data Extraction, Cloud Evidence Handling, Forensic Report Writing.

Course Outcomes (COs)

CO1: Understand the role of cyber forensics in handling and investigating cybercrimes.
CO2: Apply forensic tools for recovering and analyzing digital evidence from storage media. CO3: Perform live memory and network forensic analysis to detect anomalies.
CO4: Examine evidence from mobile and cloud platforms with legal considerations.
CO5: Demonstrate the ability to write detailed forensic reports and communicate findings.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	3	0	0	0	1	3	0
CO2	3	3	3	1	3	0	0	0	1	3	0
CO3	3	3	3	1	3	0	0	0	1	3	0
CO4	3	3	3	1	3	0	0	0	1	3	0
CO5	3	3	3	1	3	0	0	0	1	3	0

Course Name: Cloud Computing
Lab Course Code: IOT692
Semester: 6th
Credits: 1.5
Contact Hour: 3 per week

Course Objectives

1. To provide practical exposure to cloud computing platforms and services.
2. To develop the ability to deploy and manage applications on cloud infrastructure.
3. To understand virtualization, storage, and network management in cloud environments.

4. To experiment with various cloud service models like IaaS, PaaS, and SaaS.
5. To equip students with skills to use cloud security and cost management tools effectively.

Module 1: Introduction to Cloud Computing – Overview of Service Models (IaaS, PaaS, SaaS) – Hands- on with AWS/GCP/Azure Console.

Module 2: Virtual Machines and Containers – Creating and Managing Instances – Docker Basics – Snapshot and Backup Operations.

Module 3: Cloud Storage Services – Working with S3/Buckets/Blobs – File Upload and Access Control – Storage Classes.

Module 4: Deploying Web Applications – Hosting Static/Dynamic Websites – Load Balancing – Auto- scaling – CI/CD Introduction.

Module 5: Cloud Monitoring and Security – IAM Policies – Billing Dashboard – Cost Estimation – Security Tools and Logging.

Course Outcomes (COs)

CO1: Demonstrate the use of cloud service models and deployment models.
CO2: Set up and manage virtual machines and containers on cloud platforms.
CO3: Work with cloud-based storage and configure access policies.
CO4: Deploy and monitor web applications using cloud tools.
CO5: Apply cloud security practices and use cost management tools effectively.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	0	0	0	0	3	0
CO2	3	3	2	2	3	0	0	0	0	3	0
CO3	3	3	2	2	3	0	0	0	0	3	0
CO4	3	3	2	2	3	0	0	0	0	3	0
CO5	3	3	2	2	3	0	0	0	0	3	0

Course Name: Object oriented programming Lab Course Code: IOT693
Semester: 6th
Credits: 1.5
Contact Hour: 3 per week

Lab Experiments:

1. Assignments on class, constructor, overloading, inheritance, overriding

2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages

5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes

(COs) CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	0	0	0	2	3	0
CO2	3	3	2	2	3	0	0	0	2	3	0
CO3	3	3	2	2	3	0	0	0	2	3	0
CO4	3	3	2	2	3	0	0	0	2	3	0
CO5	3	3	2	2	3	0	0	0	2	3	0

4th Year7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hoursperweek				Credits
		A.THEORY			L	T	P	Total	
1	ENGG	Major	IOT701	Secure Software Engineering	3	0	0	3	3
2	ENGG	Major	IOT702	Deep Learning	3	0	0	3	3
3	ENGG	Minor	IT(IOT)701	Web Application Security	3	0	0	3	3
4	ENGG	Major	IOT703A IOT03B IOT703C	Blockchain Technology Quantum Cryptography Cyber Analytics	3	0	0	3	3
		B. PRACTICAL							
1	ENGG	Major	IOT791	Secure Software Engineering Lab	0	0	3	3	1.5
2	ENGG	Major	IOT792	Deep Learning Lab	0	0	3	3	1.5
3	ENGG	Minor	IT(IOT)791	Web Application Security Lab	0	0	3	3	1.5
4	ENGG	Major	IOT 793A IOT793B IOT793C	Blockchain Technology Lab Quantum Cryptography Lab Cyber Analytics Lab	0	0	3	3	1.5
5	ENGG	PRJ	IOT781	Project	0	0	8	8	4
TOTALCREDIT									22

Secure Software Engineering

Course Name: Secure Software Engineering
Course Code: IOT 701
Semester: 7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the principles and practices of designing and developing secure software.
2. Identify common software vulnerabilities and apply appropriate mitigation techniques.
3. Integrate security throughout the Software Development Life Cycle (SDLC).
4. Apply secure coding standards and security testing strategies.
5. Understand legal, ethical, and professional issues in secure software engineering.

Module 1: Foundations of Secure Software Development

Software security concepts and need for security, Attack surface, threat modeling, and risk analysis, Common vulnerabilities (OWASP Top 10), Role of security in software development, Principles of secure design

Module 2: Secure Software Development Lifecycle (SSDLC)

Phases of SSDLC: requirements, design, implementation, testing, deployment, maintenance, Secure coding practices and guidelines, Security design patterns and architectural risk analysis, Secure version control and configuration management

Module 3: Secure Coding Techniques

Input validation and data sanitization, Authentication and session management, Access control and authorization, Cryptography in software: principles and libraries (e.g., OpenSSL, Java Crypto API), Language-specific vulnerabilities (C/C++, Java, Python, etc.)

Module 4: Software Security Testing and Verification

Static Application Security Testing (SAST), Dynamic Application Security Testing (DAST), Penetration testing for applications, Fuzz testing and runtime verification, Secure code review and automated tools

Module 5: Advanced Topics & Legal Aspects

DevSecOps and integrating security into CI/CD pipelines, Incident response and secure deployment, Security and privacy regulations (GDPR, HIPAA, etc.), Legal and ethical considerations in software security, Case studies on real- world security breaches

Course Outcomes (COs)

1. CO1: Explain the principles and practices of secure software engineering.
2. CO2: Identify and mitigate common software vulnerabilities during different SDLC phases.
3. CO3: Apply secure coding standards and practices to software projects.
4. CO4: Utilize appropriate tools and methods for software security testing and verification.
5. CO5: Evaluate ethical, legal, and professional responsibilities in developing secure software.

CO-PO Mapping Table

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

Deep Learning

Course Title: Deep Learning
Course Code: IOT 702 Semester:
7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the fundamental concepts of deep learning and its applications.
2. Design and implement neural network models for real-world problems.
3. Analyze optimization techniques and regularization strategies in deep networks.
4. Explore various deep learning architectures such as CNNs, RNNs, and GANs.
5. Apply deep learning frameworks and tools for developing AI solutions.

Module 1: Introduction to Deep Learning

Overview of machine learning vs deep learning, Biological motivation and perceptrons, Neural network basics: architecture, activation functions, and loss functions, Gradient descent and backpropagation, Overfitting, underfitting, and regularization

Module 2: Deep Neural Networks

Deep architectures and training challenges, Weight initialization and optimization algorithms (SGD, Adam, RMSProp), Batch normalization and dropout, Hyperparameter tuning and cross-validation, Transfer learning basics

Module 3: Convolutional Neural Networks (CNNs)

Convolution and pooling operations, Architectures: LeNet, AlexNet, VGG, ResNet, Object detection: R-CNN, YOLO, SSD, Image segmentation and applications, Case studies in image classification

Module 4: Recurrent Neural Networks (RNNs) and NLP

Sequential data and recurrent networks, Vanishing gradient problem and LSTM/GRU, Natural Language Processing tasks (sentiment analysis, text generation), Word embeddings: Word2Vec, GloVe, Attention mechanisms and Transformers (intro)

Module 5: Advanced Topics and Applications

Generative Adversarial Networks (GANs), Autoencoders and Variational Autoencoders (VAEs), Reinforcement learning and deep Q-networks, Ethical considerations and challenges in deep learning, Deep learning frameworks: TensorFlow, PyTorch, Keras

Course Outcomes (COs)

1. CO1: Explain the basic principles and components of deep learning.
2. CO2: Design and implement deep neural networks for classification and regression tasks.
3. CO3: Apply CNN and RNN architectures for computer vision and sequence modeling applications.
4. CO4: Utilize deep learning frameworks and optimization strategies for effective training.
5. CO5: Evaluate and apply advanced deep learning techniques for real-world AI problems.

CO-PO Mapping Table

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

Web Application Security

Course Title: Web Application Security Course
Code: IT(IOT) 701
Semester: 7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the architecture and common vulnerabilities of web applications.
2. Identify and mitigate security risks using industry best practices.
3. Apply secure coding practices and tools for secure web development.
4. Evaluate and test the security of web applications using manual and automated methods.
5. Analyze legal, ethical, and compliance issues related to web security.

Module 1: Introduction to Web Security

Overview of web applications and architecture, Security principles for web development, Common attack vectors: Injection, XSS, CSRF, Clickjacking, OWASP Top 10 overview and risk rating methodology, Authentication and session management vulnerabilities

Module 2: Secure Development and Configuration

Secure coding practices (input validation, output encoding), Error handling, logging, and exception , management, Secure communication protocols (TLS/SSL, HTTPS), Security headers and cookie protection, Configuration management and secure deployment

Module 3: Web Security Testing

Security testing process and methodologies, Manual testing techniques and checklists, Automated security testing tools (Burp Suite, OWASP ZAP, Nikto), Static and dynamic analysis for web apps, Vulnerability assessment and penetration testing

Module 4: Legal, Ethical, and Emerging Issues

Cyber laws and compliance (GDPR, IT Act, PCI-DSS, HIPAA), Ethical hacking and responsible disclosure, Security incident handling and response, Cloud security and APIs (introductory overview), Case studies on real-world breaches and lessons learned

Course Outcomes (COs)

1. CO1: Explain fundamental concepts and risks in web application security.
2. CO2: Apply secure coding and configuration practices in web development.
3. CO3: Conduct security testing and vulnerability analysis of web applications.
4. CO4: Evaluate ethical, legal, and regulatory frameworks related to web security.

CO-PO Mapping Table

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

Blockchain Technology

Course Title: Blockchain Technology Course
Code: IOT 703A
Semester: 7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the fundamentals of blockchain technology and distributed ledger systems.
2. Explore blockchain architecture, consensus algorithms, and smart contracts.
3. Analyze the applications and limitations of blockchain in various domains.
4. Implement blockchain solutions using relevant frameworks and tools.

Module 1: Introduction to Blockchain

Concept of distributed systems and peer-to-peer networks, Structure and components of blockchain, Public vs private blockchains, Hash functions, digital signatures, and Merkle trees, Use cases and evolution of blockchain technology

Module 2: Consensus and Smart Contracts

Consensus mechanisms: Proof of Work, Proof of Stake, BFT, DPoS, Smart contract concepts and development, Blockchain platforms: Ethereum, Hyperledger, Security challenges in smart contracts, Gas cost and transaction lifecycle

Module 3: Blockchain Applications

Applications in finance: cryptocurrencies, DeFi, Supply chain and logistics, Identity management and digital voting, Healthcare and government use cases, Blockchain in IoT and cloud

Module 4: Development and Legal Frameworks

Blockchain development tools and environments (Solidity, Truffle, Remix), DApps and integration with web interfaces, Scalability and interoperability issues, Legal, regulatory, and ethical aspects of blockchain, Future trends and challenges

Course Outcomes (COs)

1. CO1: Explain the fundamental principles and structure of blockchain technology.
2. CO2: Analyze consensus algorithms and smart contract mechanisms.
3. CO3: Evaluate the applicability of blockchain across various domains.
4. CO4: Develop blockchain-based applications using relevant tools and frameworks.

CO-PO Mapping Table

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

Quantum Cryptography

Course Title: Quantum Cryptography Course
Code: IOT 703B
Semester: 7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the fundamental principles of quantum mechanics relevant to cryptography.
2. Explore the theory and implementation of quantum key distribution (QKD) protocols.
3. Analyze the advantages and limitations of quantum cryptographic techniques over classical cryptography.
4. Familiarize with quantum attacks and the impact on current cryptographic systems.

Module 1: Foundations of Quantum Mechanics

Quantum bits (qubits), superposition and entanglement, Quantum gates and circuits, Measurement in quantum systems, No-cloning theorem and quantum parallelism, Postulates of quantum mechanics

Module 2: Quantum Cryptography Basics

Classical cryptography vs quantum cryptography, Quantum Key Distribution (QKD) protocols: BB84, B92, Eavesdropping and quantum error detection, Photon polarization and quantum states, Privacy amplification and information reconciliation

Module 3: Quantum Cryptographic Systems and Protocols

Entanglement-based QKD: Ekert protocol, Device-independent QKD and measurement-device-independent QKD, Quantum random number generators (QRNGs), Quantum teleportation and dense coding, Security proof of QKD protocols

Module 4: Applications and Challenges

Quantum networks and quantum internet, Post-quantum cryptography overview, Quantum computing threats to RSA, ECC, etc., Implementation challenges and physical limitations, Recent developments and future research directions

Course Outcomes (COs)

CO Code	Course Outcome Statement
CO1	Explain quantum mechanical principles underlying quantum cryptography.
CO2	Describe and evaluate quantum key distribution protocols and their security.
CO3	Analyze the implementation of quantum cryptographic systems and protocols.
CO4	Assess the impact of quantum technologies on traditional cryptographic methods.

CO-PO Mapping Table

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

Cyber Analytics

Course Title: Cyber Analytics
Course Code: IOT 703C
Semester: 7th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

1. Understand the fundamentals of cyber analytics and its role in cybersecurity.
2. Apply data analytics and machine learning techniques for threat detection.
3. Analyze and interpret network, system, and user behavior data.
4. Develop and evaluate models for predictive and behavioral cyber defense.

Module 1: Introduction to Cyber Analytics

Overview of cybersecurity and analytics, Role of big data and data science in cybersecurity, Types of cyber threats and incidents, Data collection sources: network logs, host data, application logs, Cybersecurity metrics and KPIs

Module 2: Data Analytics for Cybersecurity

Introduction to data preprocessing and feature engineering, Descriptive, diagnostic, and predictive analytics, Exploratory data analysis (EDA) and visualization tools, Correlation analysis, anomaly detection techniques, Case studies in data-driven threat intelligence

Module 3: Machine Learning for Cyber Threat Detection

Supervised and unsupervised learning for cybersecurity, Clustering and classification algorithms (K-Means, SVM, Random Forest, etc.), Neural networks and deep learning basics in threat detection, Model evaluation and performance metrics (ROC, AUC, F1 Score), Real-world ML applications in malware, phishing, and intrusion detection

Module 4: Behavioral and Predictive Analytics

User and Entity Behavior Analytics (UEBA), Time-series and sequential data analysis, Predictive modeling for threat forecasting, SIEM and threat hunting frameworks,Challenges, ethics, and future trends in cyber analytics

Course Outcomes (COs)

CO Code	Course Outcome Statement
CO1	Explain the role of analytics in cybersecurity and data-driven threat detection.
CO2	Apply data preprocessing and visualization techniques to analyze cyber data.
CO3	Use machine learning models for classification and anomaly detection of cyber threats.
CO4	Evaluate behavioral and predictive models for cyber risk forecasting and mitigation.

CO-PO Mapping Table

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

7th Semester
Laboratory Syllabus

Secure Software Engineering Lab (IOT791) 3hrs, Credit: 1.5

Lab Objectives:

- Understand and apply secure software development practices.
- Identify and mitigate common vulnerabilities in code.
- Use tools for static and dynamic code analysis.

List of Experiments:

1. Demonstrate buffer overflow and mitigation in C/C++.
2. Input validation and sanitization in web applications.
3. Simulate SQL injection attack and write secure SQL queries.
4. Cross-Site Scripting (XSS) attack simulation and defense.
5. Static code analysis using SonarQube or Fortify.
6. Secure password storage using bcrypt/scrypt hashing.
7. Role-based access control implementation in applications.
8. Use OWASP ZAP/Burp Suite for vulnerability testing.

Deep Learning Lab (IOT792) 3hrs, Credit: 1.5

Lab Objectives:

- Learn and apply deep learning models for real-world data.
- Use TensorFlow/PyTorch frameworks for implementation.
- Visualize training metrics and model evaluation.

List of Experiments:

1. Implement a basic neural network for MNIST digit classification.
2. Train a Convolutional Neural Network (CNN) on CIFAR-10 dataset.
3. Implement a Recurrent Neural Network (RNN) for text prediction.
4. Image classification using Transfer Learning with VGG16/ResNet.
5. Implement an Autoencoder for dimensionality reduction.
6. Use LSTM for time-series forecasting.
7. Create and evaluate a GAN (Generative Adversarial Network).
8. Analyze training loss, accuracy, overfitting using TensorBoard.

Web Application Security Lab (IT(IOT)791) 3hrs, Credit: 1.5

Lab Objectives:

- Identify vulnerabilities in web applications.
- Practice secure web development techniques.
- Use OWASP tools to test application security.

List of Experiments:

1. Simulate SQL injection and implement prevention techniques.
2. Demonstrate Reflected and Stored XSS attacks.
3. Cross-Site Request Forgery (CSRF) simulation and mitigation.
4. Session management and cookie security practices.
5. Directory traversal and access control bypass simulation.
6. Implement secure authentication and login using hashing and salting.
7. Web application vulnerability scanning using Burp Suite/Nikto.
8. Input validation using server-side and client-side scripting.

Blockchain Technology Lab (IOT793A) 3hrs, Credit: 1.5

Lab Objectives:

- Understand blockchain components and smart contract development.
- Simulate transactions and distributed ledgers.
- Use Ethereum and Solidity for DApp creation.

List of Experiments:

1. Simulate a basic blockchain with proof-of-work in Python.
2. Deploy a simple smart contract using Solidity.
3. Interact with smart contracts using Web3.js.
4. Build a basic voting DApp on Ethereum.
5. Wallet creation and digital signature demo.
6. Transaction signing and block mining simulation.
7. Create a token using ERC20 standard.
8. Implement a basic supply chain DApp.

Quantum Cryptography Lab (IOT793B) 3hrs, Credit: 1.5

Lab Objectives:

- Explore principles of quantum cryptography.
- Simulate quantum key distribution.
- Use IBM Qiskit or similar toolkits.

List of Experiments:

1. Simulate BB84 Quantum Key Distribution Protocol using Qiskit.
2. Quantum entanglement visualization using IBM Quantum Composer.
3. Implement quantum teleportation algorithm.
4. Study basic quantum gates (X, H, CNOT, Z) using Qiskit.
5. Generate and measure superposition states.
6. Simulate quantum noise and analyze its impact.
7. Compare classical and quantum key exchange methods.
8. Study quantum random number generation (QRNG).

Cyber Analytics Lab (IOT793C) 3hrs, Credit: 1.5

Lab Objectives:

- Analyze cybersecurity datasets using analytics tools.
- Apply machine learning to detect threats.
- Visualize patterns in cyber data.

List of Experiments:

1. Perform exploratory data analysis (EDA) on network logs.
2. Detect anomalies in network traffic using K-Means.
3. Train a decision tree classifier for phishing detection.
4. Implement SVM for malware classification.
5. Use time-series data for threat prediction.

6. Create dashboards using Power BI/Tableau for threat monitoring.
7. Analyze user behavior patterns using UEBA.
8. Correlate multi-source data for intrusion detection.

Project (IOT 781) 8hrs, Credit: 4

4th Year8th Semester

Sl. No.	Broad Category	Category	CourseCode	Course Title	Hoursperweek				Credits
A. THEORY					L	T	P	Total	
1	ENGG	Major	IOT801A	Real-Time Systems	3	0	0	3	3
			IOT801B	Vulnerability Assessment and Penetration Testing					
			IOT801C	Soft Computing					
2	HUM	Minor	HU(IOT)801	Human Resource Development and Organizational Behavior	3	0	0	3	3
B. PRACTICAL									
1	ENGG	PRJ	IOT881	Project	0	0	16	16	11
2	ENGG	Grand Viva	IOT882	GrandViva	0	0	0	0	2
		TOTALCREDIT							19

Real-Time Systems

Course Name: Real-Time Systems
Course Code: IOT 801A
Semester: 8th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives:

1. To understand the fundamentals of real-time systems and their design principles.
2. To explore the concepts of task scheduling, resource management, and synchronization in real-time systems.
3. To analyze and design embedded systems for real-time applications.
4. To familiarize with real-time operating systems (RTOS) and their features.

Module 1: Introduction to Real-Time Systems

Definition, characteristics, and applications of real-time systems., Types of real-time, Systems: hard, firm, and soft., Basic concepts of embedded systems and real-time computing.

Module 2: Real-Time Task Scheduling

Task scheduling models and types of scheduling algorithms, Rate Monotonic Scheduling (RMS), Earliest Deadline First (EDF), Feasibility tests, priority inversion, and handling strategies.

Module 3: Real-Time Operating Systems (RTOS)

Structure and features of RTOS, Task management, inter-task communication, and synchronization, Real-time
kernels and case studies (e.g., FreeRTOS, VxWorks).

Module 4: Resource Management and System Design

- Resource sharing protocols, priority ceiling, and inheritance protocols, Real-time system design tools and case studies, Performance metrics and evaluation of real-time systems.

Course Outcomes (COs):

CO1: Understand the concepts and classifications of real-time systems.
CO2: Apply various scheduling algorithms to analyze real-time tasks.
CO3: Demonstrate the working of real-time operating systems and their components. CO4:
Design and evaluate resource management techniques in real-time systems.

CO-PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	0	1	0	0	0	1
CO2	3	3	3	2	2	0	1	0	0	0	1
CO3	2	2	3	3	2	1	1	1	0	0	2
CO4	3	3	2	2	3	0	2	1	0	0	2

Vulnerability Assessment and Penetration Testing

Course Name: Vulnerability Assessment and Penetration Testing Course
Code: IOT 801B
Semester: 8th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives:

1. To introduce the principles of vulnerability assessment and ethical hacking.
2. To provide hands-on experience in penetration testing using standard tools and techniques.
3. To understand how to detect, analyze, and mitigate common security vulnerabilities.
4. To apply industry-standard methodologies for evaluating and securing systems and networks.

Modules:

Module 1: Introduction to VAPT

Overview of Information Security, Vulnerability, Threat, Risk., Types of attacks: Active, Passive, Structured, Unstructured., Ethical Hacking: Concepts, Legal aspects, Phases of hacking., Footprinting and Reconnaissance techniques.

Module 2: Scanning and Enumeration

Network Scanning tools and techniques (e.g., Nmap, Nessus), Port scanning, Vulnerability scanning, OS fingerprinting, Enumeration tools and methodologies, Exploit databases and vulnerability assessment reports.

Module 3: Penetration Testing and Exploitation

Penetration Testing Stages: Planning, Discovery, Exploitation, Reporting, Common attack vectors: Web, Network, ystem, Wireless, Using tools like Metasploit, Burp Suite, Wireshark, Privilege escalation and maintaining access.

Module 4: Reporting and Remediation

- Creating VAPT reports: Executive summary, Technical details, Risk ratings, Compliance and standards: ISO 27001, PCI DSS, OWASP Top 10, Remediation strategies and Secure Coding practices, Case Studies and Live VAPT Demonstration.

Course Outcomes (COs):

CO1: Understand the fundamentals of vulnerabilities, threats, and ethical hacking.
CO2: Perform scanning, enumeration, and vulnerability assessment using industry tools. CO3: Demonstrate penetration testing techniques across different systems and platforms. CO4: Prepare detailed VAPT reports and recommend appropriate security countermeasures.

CO-PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	2	1	0	0	2
CO2	3	3	3	3	2	1	2	1	0	0	3
CO3	3	2	3	3	3	2	3	1	0	0	3
CO4	3	3	2	2	3	1	3	2	0	0	3

Soft Computing

Course Name: Soft Computing
Course Code: IOT 801C
Semester: 8th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

- To introduce students to the fundamental concepts of soft computing techniques.
- To provide understanding of fuzzy logic, neural networks, and genetic algorithms.
- To develop skills in implementing intelligent systems using soft computing methods.
- To expose students to real-world applications of soft computing.

Module 1: Introduction to Soft Computing

Definition and importance of soft computing, Comparison with hard computing, Techniques in soft computing: Fuzzy systems, Neural networks, Genetic algorithms, Applications and case studies

Module 2: Fuzzy Logic and Systems

Basic concepts of fuzzy logic, Fuzzy sets and membership functions, Fuzzy rules and inference systems, Defuzzification techniques, Fuzzy logic applications in control systems

Module 3: Artificial Neural Networks

Biological neuron and artificial neuron model, Types of neural networks: Feedforward, Recurrent, etc., Learning algorithms: Supervised, Unsupervised, Reinforcement, Backpropagation algorithm, Applications of neural networks in pattern recognition and classification

Module 4: Genetic Algorithms and Hybrid Systems

Introduction to genetic algorithms, Operators: Selection, Crossover, Mutation, Fitness function and convergence criteria, Applications in optimization problems, Hybrid systems: Neuro-fuzzy systems, Genetic-fuzzy systems

Course Outcomes (COs)

CO1: Understand the basics of soft computing and its applications.
CO2: Apply fuzzy logic and fuzzy reasoning to handle uncertainty and vagueness in data.
CO3: Analyze and design neural networks for various tasks.
CO4: Implement optimization techniques using genetic algorithms.

CO-PO Mapping

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	1	0	0	2	0	1	0	1	0
CO2	1	2	1	0	0	1	0	1	0	1	0
CO3	2	3	2	0	0	3	0	2	0	2	0
CO4	2	2	1	0	0	2	0	2	0	1	0

Human Resource Development and Organizational Behavior

Course Name: Human Resource Development and Organizational Behavior Course
Code: IOT 801C
Semester: 8th
Credits: 3
Contact Hours/Week: 3 (L-T-P: 3-0-0)

Course Objectives

- To provide foundational knowledge of human resource development (HRD) and organizational behavior (OB).
- To understand the roles and responsibilities of HR in developing organizational effectiveness.
- To analyze employee behavior, motivation, and leadership in organizational contexts.
- To develop practical skills to apply HRD and OB concepts in managing and leading people.

Course Modules

Module 1: Introduction to HRD and OB

- Definition and importance of HRD, Functions and processes in HRD, Introduction to organizational behavior, Role of HRD in organizational success

Module 2: Motivation and Leadership

- Motivation theories: Maslow, Herzberg, McGregor, Leadership theories and styles, Transactional and transformational leadership, Motivating employees for high performance

Module 3: Individual and Group Behavior

- Personality, perception, and attitude, Communication and interpersonal skills, Group dynamics and team building, Conflict resolution and negotiation

Module 4: Organizational Development and Change

- Organizational culture and climate, Change management and resistance to change, Organizational development interventions, Trends and challenges in HRD and OB

Course Outcomes (COs)

CO1: Understand the concepts and functions of human resource development.
CO2: Apply theories of motivation and leadership to real-life organizational situations. CO3:
Analyze organizational behavior at individual, group, and organizational levels.
CO4: Develop strategies to improve employee performance and organizational effectiveness.

CO-PO Mapping

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	0	1	2	1	2	0	2	0
CO2	3	2	2	0	1	3	1	3	0	2	0
CO3	2	2	2	1	0	2	0	2	1	2	0
CO4	2	2	3	1	1	3	1	3	1	2	0

CSE IOT 8th Semester

Laboratory Syllabus

Sl. No.	Broad Category	Category	Course Code	Course Title	L	T	P	Total	Credit
1	ENGG	PRJ	IOT881	Project	0	0	16	16	11
2	ENGG	Grand Viva	IOT882	Grand Viva	0	0	0	0	2