Guru Nanak Institute of Technology
157/F, Nilgunj Road, Panihati, Kolkata-700 114
Phone: +913325233900, Telfax: +913325637957
Website: www.gnit.ac.in,Email:info@gnit.ac.in

Guru Nanak Institute of Technology

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

R25 [B.Tech. CSE (CYS)]

Curriculum and Syllabus for B.Tech. under Autonomy

(NEP-2020 implemented)

Dept. of Computer Science and Engineering

(Effective from 2025-26 admission batch)

Guru Nanak Institute of Technology
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Curriculum for B. Tech under Autonomy (NEP-2020 Implemented)
CSE (Cyber security)

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

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1st Year 2nd 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	CS201	Data Structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
3	ENGG	Major	CS203	Digital Logic and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH201	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& Algorithms Lab	0	0	3	3	1.5
2	ENGG	Minor	CS292	Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	CS293	Digital Logic and Computer Organization Lab	0	0	3	3	1.5
4	SCI	Skill Enhancement Course	CH291	Engineering Chemistry Lab	0	0	2	2	1
5	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
C.MANDATORYACTIVITIES/ COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities/ Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
Total of Theory, Practical								**29**	**22**
Total First Year Credit									**40**

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2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CYS301	Classical Cryptography	3	0	0	3	3
2	ENGG	Major	CYS302	Computer Architecture	3	0	0	3	3
3	ENGG	Major	CYS303	Essentials of Cyber security	3	0	0	3	3
4	ENGG	Minor	CS(CYS)304	Database Management System	3	0	0	3	3
5	ENGG	Minor	IT(CYS)301	Optimization Technique	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Minor	CYS391	Classical Cryptography Lab	0	0	3	3	1
2	ENGG	Major	CYS392	Computer Architecture Lab	0	0	3	3	1.5
3	ENGG	Major	CYS393	Essentials of Cyber security Lab	0	0	3	3	1.5
4	ENGG	Major	CYS394	Database Management System Lab	0	0	3	3	1.5
5	ENGG	Major	CYS395	Introduction to Python Programming Lab	0	0	3	3	1.5
TOTAL CREDIT									**22**

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2nd Year 4th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credit points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CYS401	Machine Learning	3	1	0	4	4
2	ENGG	Major	CYS402	Computer Networks	3	0	0	3	3
3	ENGG	Major	CYS403	Ethical Hacking	3	0	0	3	3
4	HUM	Major	CYS404	Operating System	3	0	0	3	3
5	SCI	Minor	M(CYS)401	Probability and Statistics	3	0	0	0	3
B. PRACTICAL									
1	ENGG	Major	CYS491	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	Major	CYS492	Computer Networks Lab	0	0	3	3	1.5
3	ENGG	PRJ	CYS493	Android Application Development	0	0	3	3	1.5
4	ENGG	Minor	CYS494	Operating System Lab	0	0	3	3	1.5
TOTAL CREDIT									**22**

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3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CYS501	Artificial Intelligence for Cyber Security	3	0	0	3	3
2	ENGG	Major	CYS502A	Malware Analysis	3	0	0	3	3
			CYS502B	Reverse Engineering	3	0	0	3	3
			CYS502C	Applied Cryptanalysis	3	0	0	3	3
3	HUM	Minor	HU(CYS)503	Cyber Law and Ethics	3	0	0	3	3
4	ENGG	Minor	IT(CYS)501	Information and Coding Theory	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(CYS)501	Business Communication and Value Science	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	CYS591	Artificial Intelligence for Cyber Security Lab	0	0	3	3	1.5
2	ENGG	Major	CYS592A	Malware Analysis Lab	0	0	3	3	1.5
			CYS592B	Reverse Engineering Lab	0	0	3	3	1.5
			CYS592C	Applied Cryptanalysis Lab	0	0	3	3	1.5
3	ENGG	PRJ	CYS593	Project	0	0	3	3	1.5
4	Skill Enhancement Course	Internship	CYS581	Internship	0	0	2	2	2
TOTALCREDIT									**20.5**

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3rd Year 6th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits Point**
					L	**T**	**P**	**Total**	
A.THEORY									
1	ENGG	Major	CYS601	Cyber Forensics	3	0	0	3	3
2	ENGG	Major	CYS602	Digital Image Processing	3	0	0	3	3
3	ENGG	Major	CYS603	Network Security & Applied Cryptography	3	0	0	3	3
4	ENGG	Major	CYS604	Cloud Computing	3	0	0	3	3
5	ENGG	Major/Elective	CYS605A	Wireless Sensor Network Security	3	0	0	0	3
			CYS605B	Mobile and Wireless Security					
			CYS605C	Internet of Things					
B.PRACTICAL									
1	ENGG	Major	CYS691	Cyber Forensics Lab	0	0	3	3	1.5
2	ENGG	Major	CYS692	Digital Image Processing Lab	0	0	3	3	1.5
3	ENGG	Major	CYS693	Network Security & Applied Cryptography Lab	0	0	3	3	1.5
4	ENGG	PRJ	CYS694	Project	0	0	0	1.5	2
TOTALCREDIT									**21.5**

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4th Year 7th Semester									
Sl.No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits Point**
					L	**T**	**P**	**Total**	
A.THEORY									
1	ENGG	Major	CYS701	Secure Software Engineering	3	0	0	3	3
2	ENGG	Major	CYS702	Distributed Systems	3	0	0	3	3
3	ENGG	Minor	IT(CYS)701	Web Application Security	3	0	0	3	3
4	ENGG	Major	CYS703A	Blockchain Technology	3	0	0	3	3
			CYS703B	Quantum Cryptography					
			CYS703C	Cyber Analytics					
B.PRACTICAL									
1	ENGG	Major	CYS791	Secure Software Engineering Lab	0	0	3	3	1.5
2	ENGG	Major	CYS792	Distributed Systems Lab	0	0	3	3	1.5
3	ENGG	Minor	IT(CYS)791	Web Application Security Lab	0	0	3	3	1.5
4	ENGG	Major	CYS793A	Blockchain Technology Lab	0	0	3	3	1.5
			CYS793B	Quantum Cryptography Lab					
			CYS793C	Cyber Analytics Lab					
5	ENGG	PRJ	CYS781	Project	0	0	8	8	4
TOTALCREDIT									**22**

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4th Year 8th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credit point
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	CYS801A	Real-Time Systems	3	0	0	3	3
			CYS801B	Vulnerability Assessment and Penetration Testing					
			CYS801C	Soft Computing					
2	HUM	Minor	HU(CYS)801	Human Resource Development and Organizational Behavior	3	0	0	3	3
B.PRACTICAL									
1	ENGG	PRJ	CYS881	Project	0	0	16	16	11
2	ENGG	Grand Viva	CYS882	Grand Viva	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

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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 (CSE & Allied)	3	0	0	3	3
2	SCI	Multidisciplinary	PH101	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M101	Engineering Mathematics-I	3	0	0	3	3
4	HUM	Value Added Course	HU101	Environmental Science	2	0	0	2	2
5	HUM	Value Added Courses	HU102	Indian Knowledge System	1	0	0	1	1
B.PRACTICAL									
1	ENGG	Major	CS191	Introduction to Programming and Problem-Solving Lab (CSE & Allied)	0	0	3	3	1.5
2	SCI	Skill Enhancement Course	PH191	Engineering Physics Lab	0	0	3	3	1.5
3	ENGG	Skill Enhancement Course	ME194	Engineering Graphics& Computer Aided Design Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU191	Communication & Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
Total of Theory, Practical								**24**	**18**

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

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

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

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

CO-PO-PSO Mapping:

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

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

- History and generations of computers
- Classification: Digital, Analog, Hybrid, Micro, Mini, Mainframe
- Computer architecture: Input/output units, Memory (Primary & Secondary), CPU
- Number systems: Binary, Octal, Decimal, Hexadecimal

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- Conversions among number systems
- Signed number representations: 1's, 2's complement
- Floating point representation: IEEE 754 single & double precision
- ASCII codes
- Overview of compiler, interpreter, assembler

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

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

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

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

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

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

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

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

Textbook:

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

Reference Books:

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

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

CO-PO Mapping:

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

Course Content:
Module 1 (11L)
Modern Optics
1.01- Laser (6L): Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems.
1.02-Fibre Optics (3L): 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.
1.03-Holography(2L): Theory of holography (qualitative analysis), viewing of holography, applications

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Module 2 (5L)
Solid State Physics
2.01 Crystal Structure(3L): 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.
2.02 Semiconductor(2L): Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.
Module 3 (14L)
Quantum and Statistical Mechanics
3.01 Quantum Theory(5L): Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: Black body radiation, Photoelectric and Compton Effect: no derivation required), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems.
3.02 Quantum Mechanics 1(4L): 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).

3.03Statistical Mechanics (5L):
Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level-Qualitative discussion.
Module 4 (4L)
Physics of Nanomaterials
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 (2L)
Storage and display devices
Different storage and display devices-Magnetic storage materials, Operation and application of CRT, CRO, LED and OLED.
Text books:
1. Concepts of Modern Engineering Physics- A. S. Vasudeva. (S. Chand Publishers)
2. Engineering Physics - Rakesh Dogra
3. Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J. Owens.
Reference books:
1. Optics - Ajay Ghatak (TMH)
2. Solid state Physics - S. O. Pillai
3. Quantum mechanics -A.K. Ghatak and S Lokenathan
4. Fundamental of Statistical Mechanics: B. B. Laud
6. Perspective & Concept of Modern Physics—Arthur Beiser

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Course Name: Engineering Mathematics - I
Course Code: M 101
Contact (L: T: P): 3 :0 : 0
Total Contact Hours: 36
Credit: 3

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

Course 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. Apply linear algebra methods to perform matrix operations, classify matrix structures, solve systems of linear equations, and compute eigen values and eigenvectors in engineering contexts.
CO2. Apply differential and integral calculus to evaluate and approximate the behavior of single- variable and multivariable real-valued functions relevant to engineering scenarios.
CO3. Analyzethepropertiesofeigenvaluesandeigenvectorstoassessmatrixdiagonalizabilityand interpret linear transformations using the Cayley-Hamilton theorem in engineering systems.
CO4. Analyzesingle-variableandmultivariablereal-valuedfunctionsusingdifferentialandintegral calculus to model and interpret complex behavior in engineering applications.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	1	1	-	-	-	-	-	-	2
CO4	3	3	1	1	-	-	-	-	-	-	2
M 101	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**

WeightageValues: Stronglymapped:‘3’,Moderatelymapped:‘2’,Weaklymapped:‘1’,Notmapped:’-‘.

Course Content:
Module I: Liner Algebra (11L)
Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)
Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Taylor's series.

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

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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.
4. 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: Environmental Science
Course Code: HU 101
Credits: 2
Contact Hours: 24
Prerequisites: 10+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.

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Course Outcome

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 environmental and health risk
CO3: Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Module 1 - Resources and Ecosystem (6L)

1.1 Resources (4L)

Types of resources, Human resource, Population Growth models: Exponential Growth, Logistic growth curve with explanation. Maximum Sustainable Yield [Derivation]
Alternative sources of Energy [Solar energy, tidal energy, geothermal energy, biomass energy]

1.2 Ecosystem (2L)

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

Module 2 – Environmental Degradation (10L)

2.1 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.

2.2 Water Pollution and its impact on Environment (4L)

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

2.3 Land Pollution and its impact on Environment (1L)

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

2.4 Noise Pollution and its impact on Environment (2L)

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

Module 3 – Environmental Management (6L)

3.1 Environmental Impact Assessment (1L)

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

3.2Pollution Control and Treatment (2L)

Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator.
Wastewater Treatment (Surface water treatment &Activated sludge process), Removal of hardness of water (Temporary &Permanent -Permutitprocess).

3.3Waste Management (3L)

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

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Module 4 – Disaster Management (2L)

4.1 Study of some important disasters (1L)

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

4.2Disaster Management Techniques (1L)

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

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT), Gourkrishna Dasmohapatra, Vikas Publishing.
2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.
3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.
2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

Course Name: Indian Knowledge System
Course Code: HU102
Contact: 1:0:0
Credit: 01
No. of lectures: 12

Course outcome: On completing this course the student will be able

CO1: To define, identify, describe and classify the philosophical, literary and socio-religious heritage of ancient India and the core concepts of the Vedic corpus and way of life.

CO2: To discover, enumerate, compare, contrast and categorize the importance of pioneering developments in science and mathematics and evaluate their continuing relevance.

CO3: To analyze, appraise, correlate and describe the ancient Indian heritage in science and technology and examine technological correlations with present-day technological applications.

CO4: To discover, assess and describe traditional knowledge in health care, architecture, agriculture and other sectors and to explore the history of traditional Indian art forms.

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CO-PO Mapping:

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

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 (Orthodox and Unorthodox).

Module-2 (3L) **Salient features of the Indian numeral system**: Developments in Indian Mathematics in ancient India - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers- Contribution of ancient Indian mathematicians
Highlights of Indian Astronomy: Historical development of astronomy in India- key contributions of ancient Indian astronomers.

Module-3 (3L)
Indian science and technology heritage: Metals and metalworking - Mining and ore extraction –Structural engineering and architecture in ancient India: planning, materials, construction and approaches- Dyes and painting; Shipbuilding.

Module-4 (3L)
Traditional Knowledge in Different Sectors: Traditional knowledge and engineering. Traditional Agricultural practices (resources, methods, technical aids); Traditional Medicine and Surgery; History of traditional Art forms and Culture.

Text Books:
1. Amit Jha.*Traditional Knowledge System in India*. New Delhi: Atlantic Publishers, 2024.
2. B. Mahadevan, VinayakRajat Bhat, Nagendra Pavana.*Introduction to Indian Knowledge System: Concepts and Applications*. New Delhi: PHI, 2022.
3. Angad Godbole. *Science and Technology in Ancient India*. New Delhi: Biblia Implex, 2023.
4. Pritilakshmi Swain. *Indian Knowledge System*. New Delhi: Redshine Publication, 2024.
5. Vishnudut Purohit. *Fundamentals of Indian Knowledge System*. New Delhi: ABD Publishers, 2024.

Reference Books:
1. L. Basham. *The Wonder that was India*. Vol. I. New Delhi: Picador, 2019.
2. Arun Kumar Jha and Seema Sahay ed. *Aspects of Science and Technology in Ancient India.* Oxford and New Delhi: Taylor and Francis, 2023.
3. Kapil Kapoor and Awadhesh Kumar Singh. *Indian Knowledge Systems*. Vols. 1 and 2. New Delhi: D. K. Printworld, 2005.

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Course Name: Introduction to Programming and Problem-Solving Lab
Course Code: CS191
Contact Hours: 0:0:3
Total Contact Hours: 36
Credits: 1.5

Course Objectives

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

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

Course Outcomes (COs)

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

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

CO-PO Mapping:

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

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Course Content:

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

Textbook:

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

Reference Books:

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

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157/F, Nilgunj Road, Panihati, Kolkata-700 114
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Website: www.gnit.ac.in,Email:info@gnit.ac.in

Course Name: Engineering Physics Lab
Course Code: PH191
Contact: (0:0:3)
Total Contact Hours: 36
Credits: 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
After completion of this course the students will be able to

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

CO-PO Mapping

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

Course Content:

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide callipers/ 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.

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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.
10a. Study of characteristics of solar cell (illumination, areal, spectral)
10b. Study of characteristics of solar cell (I-V characteristics, Power-load characteristics, Power-wavelength characteristics)

Perform at least one of the following experiments:
11. Determination of Q factor using LCR Circuit.
12. Study of I-V characteristics of a LED/LDR.
13. Determination of band gap of a semiconductor.
**In addition, it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

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

Recommended Text Books for Engineering Physics Lab:

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit Classical & Modern Optics:
2. A text book of Light- K.G. Mazumder & B.Ghosh (Book & Allied Publisher)

Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House) Solid-state Physics
2. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R.K. Kar (Book & Allied Publisher)

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Course Name: Engineering Graphics & Computer Aided Design Lab
Course Code: ME 194
Contact: 0:0:3
Credits: 1.5

Prerequisites: Basic knowledge of geometry

Course Outcomes: Upon successful completion of this course, the student will be able to:
CO1: Use common drafting tools with the knowledge of drafting standards.
CO3: Understand the concepts of engineering scales, projections, sections.
CO4: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO5: Produce part models; carry out assembly operation and represent a design project work.

CO-PO/PSO Mapping:

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

Course Contents:

Basic Engineering Graphics:3P

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

Module 1: Introduction to Engineering Drawing: 6P

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

Module 2: Orthographic & Isometric Projections: 6P

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

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Module 3: Sections and Sectional Views of Right Angular Solids: 6P
Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics:3P
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics: 3P
Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering: 6P
Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project: 3P
Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:
1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House
2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:
1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers.

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157/F, Nilgunj Road, Panihati, Kolkata-700 114
Phone: +913325233900, Telfax: +913325637957
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Course Name: Communication and Presentation Skill
Course Code: HU191
Contact: (0:0:3)
Total Contact Hours: 36
Credit: 1.5

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: 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 and Soft Skills through Language Laboratory.
CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3: Analyze, compare and adapt the skills necessary to be a competent interpersonal communicator in academic and global business environments.
CO4: Deconstruct, appraise and critique professional writing documents, models and templates.
CO5: Adapt, negotiate, facilitate and collaborate with communicative competence in presentations and work-specific conclaves and interactions in the professional context.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction Theories of Communication and Soft Skills

a. Communication and the Cyclic Process of Communication (Theory, benefits and application)
b. Introduction to Workplace Communication (Principles and Practice)
c. Non-Verbal communication and its application
d. Soft Skills Introduction: Soft-Skills Introduction
e. What is Soft Skills? Significance of Soft-Skills
f. Soft-Skills Vs. Hard Skills
g. Components of Soft Skills Identifying and Exhibiting Soft-Skills (Through classroom activity)

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Module 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening.
d. Listening in Business Telephony and PracticePractical (Role plays, case studies)

Module 3: Speaking Skills

a. Effective Public Speaking: Public Speaking, Selecting the topic for public speaking, (Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, delivering the speech, Voice Clarity). Practical (Extempore)
   Self-Learning Topics: Preparation, Attire, Posture and Delivery techniques
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focused activities—JAM, Conversational Role Plays, Speaking using Picture/AudioVisual inputs
d. Group Discussion: Principles, Do's and Don'ts and Practice;

Module 4: Writing and Reading Comprehension

a. Reading and Writing a Book Review (classroom activity)
b. Writing a Film Review after watching a short film (classroom activity)
c. Reading Strategies: active reading, note-taking, summarizing, and using visual aids like diagrams and graphs
d. Solving Company-Specific Verbal Aptitude papers. (Synonyms, Antonyms, Error (Correction and RC Passages)

Module 5: Presentation Skills

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

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

Text Books:

1. Pushp Lata and Sanjay Kumar. *A Handbook of Group Discussions and Job Interviews*. New Delhi: PHI, 2009.
2. Jo Billingham. *Giving Presentations*. New Delhi: Oxford University Press, 2003.
3. B. Jean Naterop and Rod Revell. *Telephoning in English*. 3rd ed. Cambridge: Cambridge University Press, 2004.

Reference Books:

1. Ann Baker. *Ship or Sheep? An Intermediate Pronunciation Course*. Cambridge: Cambridge University Press, 2006.
2. Barry Cusack and Sam McCarter. *Improve Your IELTS: Listening and Speaking Skills.* London: Macmillan, 2007.
3. Eric H. Glendinning and Beverly Holmström. *Study Reading.* Cambridge: Cambridge University Press, 2004.
4.Malcolm Goodale. *Professional Presentations*. New Delhi: Cambridge University Press, 2005.

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1st Year 2nd 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	CS201	Data Structure and Algorithms	3	0	0	3	3
2	ENGG	Minor	CS202	Introduction to Artificial Intelligence	2	0	0	2	2
3	ENGG	Major	CS203	Digital Logic and Computer Organization	3	0	0	3	3
4	SCI	Multidisciplinary	CH201	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 & Algorithms Lab	0	0	3	3	1.5
2	ENGG	Minor	CS292	Artificial Intelligence Lab	0	0	3	3	1.5
3	ENGG	Major	CS293	Digital Logic and Computer Organization Lab	0	0	3	3	1.5
4	SCI	Skill Enhancement Course	CH291	Engineering Chemistry Lab	0	0	2	2	1
5	ENGG	Skill Enhancement Course	ME293	IDEA LAB Workshop	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
Total of Theory, Practical								**29**	**22**
Total First Year Credit									**40**

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157/F, Nilgunj Road, Panihati, Kolkata-700 114
Phone: +913325233900, Telfax: +913325637957
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Course Name: Data Structures and Algorithms
Course Code: CS201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

Course Objective(s):

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

- Gain a strong foundation in data abstraction, data types, and data structures, and understand the importance of structured data organization in solving engineering problems.
- Formulate and analyze algorithms, perform asymptotic analysis using Big O, Θ (Theta), and Ω (Omega) notations, and comprehend the trade-offs between time and space complexities.
- Design and implement linear and non-linear data structures such as arrays, linked lists, stacks, queues, trees, heaps, and graphs, and apply them effectively in computational problem-solving.
- Evaluate and compare various searching, sorting, and hashing algorithms based on their performance, and choose appropriate methods for optimized data handling.
- Appreciate the role of data structures in real-world applications, foster a mindset of lifelong learning, and develop the adaptability to utilize modern programming tools and emerging technologies.

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

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

CO-PO-PSO Mapping:

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

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Course Content:

Module 1: Introduction 4L
Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures.
Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Small Oh(o), Big Omega(Ω), Small Omega(ω) and Theta(Θ) notation (definition and significance).

Module 2: Non-Restricted Linear Data Structure 9L
List or Linear List: Definition and Example, List as ADT. Representation of Linear List- Sequential Representation and Linked Representation.
Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array- representation of polynomial using array, Representation of Sparse matrix using array.
Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.

Module 3: Restricted Linear Data Structure 6L
Stack: Definition of Stack, implementations of stack using array and linked list
Applications of stack- infix to postfix conversion, Postfix Evaluation
Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion.
Queue: Definition of Queue; Implementation of queue using array-physical, linear and circular model; Implementation of queue using linked list.
Dequeue - Definition and different types of dequeue.

Module 4: Nonlinear Data structures 9L
Trees and Binary Tree:
Basic terminologies; Definition of tree and binary tree. Difference between tree and binary tree, Representation of binary tree (using array and linked list)
Binary tree traversal (pre-, in-, post- order); Threaded binary tree- definition, insertion and deletion algorithm; Binary search tree- Definition, insertion, deletion, searching algorithm;
Height balanced binary tree: AVL tree- definition, insertion and deletion with examples only.
m –Way Search Tree: B Tree – Definition, insertion and deletion with examples only; B+ Tree – Definition, insertion and deletion with examples only.
Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm. Application of heap (priority queue and sorting).
Graphs: Definition and representation (adjacency matrix, incidence matrix and adjacency list).
Graph traversal– Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge).

Module 5: Sorting and Searching 8L
Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm (internal, external, stable, in-place, comparison based); Factors affecting sorting Methods, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort – algorithm with analysis (time complexity)
Searching: Factors affecting searching Methods; Sequential search –algorithm with analysis (time complexity); improvement using sentinel.
Binary search and Interpolation Search algorithm with analysis (time complexity)

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

Text book:

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

Reference Books:

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

Course Name:	**Introduction to Artificial Intelligence**
Course Code:	**CS202**
Contact Hours(Period/week):	**2**
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. Design AI-Frameworks for Inferencing based on knowledge base.
5. Analyze the effectiveness of AI-Inferencing Model in offering solutions to the respective problem.

Course Outcomes (COs):

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

CO1	Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	Identify and formulate an engineering problem primarily to fit a State-Space ExplorationFrameworkoranInferencingModel/AgentDesignFrameworkwithinthe scope of Artificial Intelligence paradigm.
CO3	Explore relevant literature and apply the concept of Heuristic Techniques of Artificial Intelligence to solve problems.

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CO4	Develop Inferencing Models for proposing solutions to the problems of Artificial Intelligence.
CO5	Implement Inferencing Models of Artificial Intelligence through developing feasible algorithms and investigate their effectiveness by analyzing their performances in solving the relevant problems.

CO–PO Mapping:

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

Course Contents:

Module1: Introduction to Artificial Intelligence(3 L)

WhyAI•DefinitionofAI•GoalsofAI•HistoryandevolutionofAI•TypesofAI:Narrow, General, Super •Human vs Artificial Intelligence •Applications of AI in various domains• AI for social good

Module2: Intelligent Agents and Logic-Based Thinking(8L)

Intelligent systems • Agents and environments • Decision making using rules and logic • SymbolicAIconcepts•PropositionalLogic:KnowledgeRepresentationandInferenceusing Propositional Logic• Predicate Logic: Knowledge Representation, Inference, and Answer Extraction using First Order predicate Logic

Module3: Overview of AI Branches and Perception (8 L)

Machinelearning•Deeplearning•Naturallanguageprocessing•Computervision•Expert systems • Fuzzy logic • Evolutionary algorithms • Reinforcement learning • Planning and scheduling • Human-AI collaboration

Module4: **Basics of Machine Learning(6L)**

Whatismachinelearning•AIvsML•Typesoflearning:supervised,unsupervised•Concept of dataset,features,andlabels•MLmodelandpredictionflow•CommonMLapplications Introduction to decision trees(concept only)•ML pipeline overview.

Module5: **Applications and Ethics of AI(5L)**

AI in robotics and automation • AI-enabled smart applications • Industry4.0 and intelligent systems•AIindifferentsectors:healthcare,agriculture,transport,education,etc.•Human- AI teamwork•BasicsofAIethics:bias,fairness,privacy•Careeropportunitiesandfuture Scopes in AI.

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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. and Norvig, P.2015.ArtificialIntelligence-AModernApproach,3rd edition, Prentice Hall.

Reference Books:

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

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CO-PO Mapping:

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

Course Content

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

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

Module 2: Combinational Circuits (6 L)d

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

Module 3: Sequential Circuits & Registers (6 L)

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

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

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

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

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

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

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

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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 Digital Fundamentals by *Thomas L. Floyd,* Pearson Education, 11th Edition

Course Name: Engineering Chemistry
Paper Code: CH201
Total Contact Hours: 24
Credit: 2
Prerequisites: 10+2

COURSE OBJECTIVE

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

COURSE OUTCOME

After completion of this course the students will be able to

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

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CO-PO mapping:

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

COURSE CONTENT

Module 1:

Quantum Properties of Atoms (4L)
Schrodinger Wave Equation (time independent – basic principles only), de Broglie Equation, Heisenberg Uncertainty Principle, Quantum Numbers, Effective nuclear charge, Slater's rule, penetration of orbitals, variations of orbital energies in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation properties.

Chemistry of materials (2L)
Semiconductor-Based Memory Materials (Si & Ge) [Introduction, Properties and role of Si & Ge), Intensive & Extensive semiconductor

Module II:

Chemical Thermodynamics (5L)

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

Electricity production through chemical reactions (2L)

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

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

Working principle and applications of Lithium-ion batteries

Module III:

Polymers for Engineering Applications (3L)

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

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

Conducting polymers –Types examples and applications.

Biodegradable polymers –definition, example and uses

Industrial Chemistry (3L)

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

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

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

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

Module IV:

Organic Reactions & synthesis of drugs (3L)

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

Spectroscopy (2L)

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

Text Books:

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

Reference Books:

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

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

Prerequisites:

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

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

CO-PO/PSO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	1
CO3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	1	1	-	-	-	-	-	-	2
M 201	**3**	**2.25**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**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)

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

Solution of first order and higher degree ODE: solvable for$p$,solvable for y and solvable for $x$and Clairaut's equation.

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

Solution of second order ODE with constant coefficients: Complementary Functionand Particular Integral, Method of variation ofparameters, 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, Changeof scale property, LT of $tf(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improperintegrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties,Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution oflinear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

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

Text Books:

1. 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.

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Course Name: **Constitution of India and Professional Ethics**
Course Code: HU202
Contact: 1:0:0
Credit: 1
Total Lectures: 12
Prerequisites:
Basic knowledge (10+2 level) of the Indian Constitution and moral science.

Course outcome: On completing this course the student will be able to

CO1: Identify, define and understand the significance of the Constitution of India, its spirit and values and the fundamental rights and duties as a responsible citizen.
CO2: define and discover core ethical concepts, the basic perception of profession, and professional ethics that shape the ethical behavior of an engineer.
CO3: identify, examine and apply codes of engineering ethics, engineers' social responsibilities and industrial standards and ethical dilemmas.
CO4: consider, correlate and appraise ethical leadership and principles in addressing gender issues, concerns of IPR and industrial responsibilities.

Module 1: [2L]
Preamble: Salient Features, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliament -Powers and Functions –Executive- President -Governor - Council of Ministers.

Module 2:[3L]
Introduction to Ethical Thinking; what is Ethics, Work ethics; Scope of Professional Ethics, Values and Characteristics, Types of values: Negative and positive values, Ethical values for Professional success.

Module 3: [4L]

Engineering Ethics, Ethical theories: a brief overview; utilitarianism, deontology, virtue ethics.
Professional Codes, Codes of professional ethics-Moral dilemmas, and moral autonomy- Internal ethics of business: whistle blowing, conflicts of interest, Job discrimination, and Exploitation of Employees; Social and ethical responsibilities of technologists: Responsibilities towards Customers, shareholders, employees – Social Audit.

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

Module 4:[3L]
Business ethics, ethical decision-making frameworks - Impact of ethics on business policies and strategies-Characteristics of ethical leaders; fostering integrity in teams; Addressing occupational crime, discrimination, and gender-based issues in workplaces-Intellectual property rights (IPR), Plagiarism and Academic Misconduct.

Text Books:
1. Durga Das Basu. *Introduction to the Constitution of India*. 27th ed. New Delhi: Lexis Nexis, 2024.
2. R.S Nagarajan. *A Textbook on Professional Ethics and Human Values*. New Age International (P) Limited, 2022.
3. N. Subramanian. *Professional Ethics.* New Delhi: Oxford University Press, 2017.
4. A N Tripathi, *Human Values*. New Delhi: New Age Publishers, 2019.

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

Reference Books:

1. O. C. Ferrell, John Friaedrich and Linda Ferrell. *Business Ethics: Ethical Decision Making and Cases.* New Delhi: Cengage India, 2024.
2. Charles Fledderman. *Engineering Ethics*. 3rd ed. New Delhi: Pearson Education, 2007.
3. Dinesh G. Harkut and Gajendra R. Bamnote. *Professional Ethics for Engineers*. Chennai: Notion Press, 2023.
4. U.C.Mathur, *Corporate Governance and Business Ethics*: *Text and Cases*. Chennai: Macmillan, 2012.
5. Fernando. A. C., K. P. Muralidheeran and E. K. Satheesh. *Business Ethics – An Indian Perspective*. New Delhi: Pearson Education, 2019.

CO-PO Mapping:

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

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Course Title	**Design Thinking and Innovation**		
Course Code	**HU203**		
(L-T-P)	**(2-0-0)**		
Class Hours/Week	**02**		
Total class hours	**30**		

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.

CourseOutcomes(COs): Uponcompletionofthecourse,studentsshallbeableto

Sl. No.	Course outcomes	Mapping to POs
1.	Analyzeemotionalexperienceandexpressionstobetterunderstandstakeholderswhiledesigninginnovative 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.	DevelopnewwaysofcreativethinkingandlearntheinnovationcycleofDesignThinking process for developing any innovative products using facility in AICTE IDEALAB	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO10 & PO11

CO-PO MAPPING:

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

Prerequisites:
For a course on the Basics of Design Thinking, students should ideally possess basic computer skills, communication abilities, problem-solving aptitude, critical thinking, introductory knowledge of Sustainable Development Goals, curiosity, and openness to new ideas, as well as basic understanding of mathematics, technology, and manufacturing processes.
However, even if these prerequisites are not satisfied, the faculty will cover them in the first few classes. An awareness of 21st-century skills, including creativity and collaboration, is also beneficial. These prerequisites aim to provide a foundation, and any gaps in knowledge will be addressed by the instructor early in the course.

SYLLABUS:

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

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	Sharedmodelinteam-baseddesign–TheoryandpracticeinDesignthinking– Explorepresentationsigners across globe– MV Por 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).	
Module 3:	**Tools for Design Thinking** Real-Timedesigninteractioncapturesandanalysis– Enablingefficientcollaborationindigitalspace–Empathyfordesign– CollaborationindistributedDesign	3
Module 4:	**Design Thinking in IT** Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping	2
Module 5:	**Design Thinking For strategic innovations** Growth – Story telling representation – Strategic Foresight - Change – Sense Making - MaintenanceRelevance–Valueredefinition-ExtremeCompetition– experiencedesign-Standardization–Humanization-CreativeCulture– Rapidprototyping,StrategyandOrganization–BusinessModel	3
Module 6:	**Problem Solving & Critical thinking** Introduction to TRIZ, SCAMPER, UI and UX.	2
Module 7:	**Sustainable development goals (SDG)** Integrating and mapping 17 Sustainable development goals (SDG) during designing a product; goods or service. Introduction to 21st CenturySkillSet	1
Module 8:	**Case Study & Project Report Submission**	10

Text Books:

1. KarminDesignThinkingbyDr.BalaRamadurai,MudranikTechnologyPrivateLtd.ISBN978-93-5419-0I0-0.
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

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

WEB REFERENCES:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview
5. www.tutor2u.net/business/presentations/. /productlifecycle/default.html
6. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
7. www.bizfilings.com › Home › Marketing › Product Developmen
8. https://www.mindtools.com/brainstm.html
9. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
10. www.vertabelo.com/blog/documentation/reverse-engineering https://support.microsoft.com/en-us/kb/273814
11. https://support.google.com/docs/answer/179740?hl=en

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

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

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

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

CO1	Apply fundamental programming concepts to construct and manipulate linear data structures like arrays, linked list, stacks, and queues for solving structured problems.
CO2	Develop and analyze non-linear data structures such as binary search trees to address hierarchical and dynamic memory-based problems.
CO3	Implement recursive algorithms to solve classical problems like Tower of Hanoi and Fibonacci series, demonstrating critical thinking and abstraction.
CO4	Compare and evaluate various sorting and searching algorithms based on time and space complexity for performance-critical applications.
CO5	Design and integrate suitable data structures to build efficient software modules, demonstrating teamwork, project planning, and communication of technical results.

CO-PO-PSO Mapping:

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

Course Content:

Lab No.	Title	Topics / Experiments
1	Introduction to C Revisions	Basic C programming constructs, functions, pointer concepts.
2	Arrays and Polynomial Representation	Create, access and manipulate 1D, 2D arrays; polynomial representation using arrays.
3	Linked Lists	Singly Linked List: creation, insertion, deletion, search.
4	Doubly & Circular Linked Lists	Implement doubly linked and circular linked list with insertion/deletion.
5	Stacks (Array & Linked List)	Implement stack using array and linked list.
6	Application of Stack	infix to postfix conversion, postfix evaluation.
7	Queues (Array & Linked List)	Physical, Linear and circular model of queues using array, Queue Using linked list.
8	Recursion Applications	Factorial, Fibonacci, Tower of Hanoi.
9	Binary Search Tree (BST)	Insertion, deletion, searching; height of tree.
10	Sorting Algorithms	Implement of bubble sort, insertion sort, and selection sort.
11	Sorting Algorithms	Implement of quick, merge sort, and radix sort.
12	Searching and Hashing	Linear search, binary search, interpolation search;

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Text books:

1. DataStructuresThrough'C'LanguagebySamiranChattopadhyay,DebabrataGhosh 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. DataStructures,Algorithms,andSoftwarePrinciplesinCbyThomasA.Standish,1 Edition, Pearson.
2. DataStructuresbyS.Lipschutz,SpecialIndianEdition,TataMcGrawHillEducation (India) Private Limited
3. Data Structures and Program Design in C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson.

Course Name:	**Artificial Intelligence Lab**
Course Code:	**CS292**
Contact Hours(Period/week):	**3P/Week**
Total Contact Hours:	**30**
Credit:	**1.5**

Course Objectives:

The objectives of this course are to enable students to

1. GainfoundationalknowledgeofPROLOGtoimplementanArtificialIntelligent 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. ApplytheconceptsofArtificialIntelligencetosolveaproblembyimplementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
4. BuildexpertsystemsofferingsolutionstothechallengingproblemsofArtificial Intelligence.
5. ImplementArtificialIntelligencebasedideasasexecutablePROLOGprograms through developing intelligent heuristic strategies

Course Outcomes (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.

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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	ExplorerelevantliteratureandapplytheconceptsofArtificialIntelligencetosolve aproblembyimplementingwell-knownArtificialIntelligencestrategiesusing 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 adequatedocumentationinacollaborativeenvironmentforsuccessfullycarryingout projects on Artificial Intelligence Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools.

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 using PROLOG Programming and its working strategy. Understanding facts, rules, queries, and syntax.

Module2: Recursive definitions in Prolog
Fibonacci Series, Calculator, Factorial, summation, list length, etc. Using recursive rules.

Module3:Defining facts and simple queries
Writing a knowledgebase for family relationships, basic objects.

Module4: **Rules and inference in Prolog**
Creating logical rules and testing inferences.

Module5: List operations in Prolog
Checking membership, concatenation, reverse, max/min of list.

Module6:Patternmatchingandsymbolicreasoning
Simple examples involving pattern recognition (e.g., shape or name matching, Family Tree design)

Module7:Expertsystemsimulation(Miniproject)
Building a mini knowledge-based system (e.g., Animal Classification, Medical diagnosis, etc).

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Phone: +913325233900, Telfax: +913325637957
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Textbook:

1. IvanBratko,PrologProgrammingforArtificialIntelligence,4thEdition, Addison-Wesley.

CO–POMapping:

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

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:

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

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

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

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Website: www.gnit.ac.in,Email:info@gnit.ac.in

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 & Subtractor	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 Demultiplexer	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 behaviour.
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:

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

Reference Books:

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

Course Name: Engineering Chemistry Lab
Paper Code: CH 291
Total Contact Hours: 24
Credit: 2
Prerequisites: 10+2

Course Objective

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

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

COURSE CONTENT

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

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1. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution.
2. Estimation of amount of Fe^{2+} in Mohr's salt using permanganometry.
3. To determine the surface tension of a given liquid at room temperature using stalagmo meter by drop number method.
4. Todeterminetheviscosityofagivenunknownliquidwithrespecttowateratroomtemperature,byOstwald'sViscometer.
5. Water quality analysis:
   i. Determination of total, permanent and temporary hardness of sample water by complexometric titration.
   ii. Determination of Cl^- ion of the sample water by Argentometric method.
   iii. Determination of alkalinity of the sample water.
   iv. Determination of dissolved oxygen present in a given water sample.
6. Determination of the concentration of the electrolyte through pH measurement.
7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
8. Determination of cell constant and conductance of solutions.
9. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
10. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
11. Drug design and synthesis
12. Synthesis of polymers (Bakelite) for electrical devices and PCBs.
13. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
14. Determination of R_F of any amino acid by thin layer chromatography.
15. Saponification /acid value of any oil.
16. Isolation of graphene from dead dry batteries

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Course Name: IDEA Lab Workshop

Course Code	**:**	**ME293**
Course Title	**:**	**IDEA Lab Workshop**
Number of Credits	**:**	**(L:0,T:0,P:3)**
Credit	**:**	**1.5**

Course Objectives:

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

Course Contents*:*

Module	Topics	
1	Electronic Component familiarisation and understanding of electronic system design flow, including schematic design, PCB layout, and Gerber file creation using Eagle CAD. Documentation skills using Doxygen, Google Docs, and Overleaf. Proficiency in version control tools such as Git and GitHub. Basic 2D and 3D designing using CAD tools including FreeCAD, SketchUp, PrusaSlicer, FlatCAM, Inkscape, OpenBSP, and VeriCUT.	Introduction to basic hand tools, including tape measure, combination square, vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, as well as tapping and threading techniques. Knowledge of adhesives. Introduction to power tools such as power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, and rotary tools, along with various types of drill bits.
2	Familiarisation and use of basic measurement instruments, including Digital Storage Oscilloscope (DSO) with various triggering modes and probes, Digital Multimeter (DMM), LCR bridge, signal and function generators, logic analyzer, and Mixed Signal Oscilloscope (MSO). Experience with bench power supplies featuring 4-wire output. Circuit prototyping using breadboards, Zero PCBs, Manhattan-style construction, and custom PCBs. Knowledge of single-, double-, and multilayer PCBs, including in-lab fabrication of single- and double-sided PCB prototypes. Proficiency in soldering using	Mechanical cutting processes - 3-axisCNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab a board a Box.

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	soldering iron/station and temperature-controlled reflow oven, along with exposure to automated circuit assembly and soldering using pick-and-place machines.	
3	Understanding of electronic circuit building blocks, including commonly used sensors. Experience in Arduino and Raspberry Pi programming and applications. Knowledge of digital input and output operations, time and event measurement, PWM (Pulse Width Modulation), serial communication, analog input, and interrupt programming. Familiarity with power supply design, including linear and switching types, as well as wireless power transfer, USB Power Delivery (USB-PD), solar panels, battery types, and charging techniques	Knowledge of 3D printing and prototyping technologies, including FDM, SLS, and SLA methods. Understanding of basic 3D scanning and point cloud data generation for reverse engineering. Experience in prototyping using subtractive cutting processes, as well as building 2D and 3D structures using laser cutters and CNC routers. Familiarity with the basics of Intellectual Property Rights (IPR) and patents, including accessing and utilizing patent information in an IDEA Lab environment.
4	Discussion, design, and implementation of a mini project.	
5	Documentation of the mini project, including report writing and video presentation.	

Laboratory Activities:

Sl. No.	List of Lab activities and experiments
1.	Schematic and PCB layout design of a suitable circuit, fabrication and test of the circuit.
2.	Machining of 3D geometries on soft materials such as softwood or modeling wax.
3.	3D scanning of a computer mouse geometry surface and 3D printing of the scanned model using FDM or SLA printers.
4.	2D profile cutting of press-fit boxes/casings using acrylic (3 or 6 mm thickness), cardboard, and MDF (2 mm) boards with a laser cutter and engraver.
5.	2D profile cutting on plywood and MDF (6–12 mm) for press-fit designs.
6.	Familiarity and use of welding equipment.
7.	Familiarity and use of normal and wood lathe.
8.	Embedded programming using Adriano and/or RaspberryPi.

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9.	Design and implementation of a capstone project involving embedded hardware and software, along with a machined or 3D-printed enclosure.

CO-PO Mapping Table

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

Mapping levels: 1 – Slight, 2 – Moderate, 3 – Substantial

List of Suggested Experiments

1. Study and setup of a basic Cyber Forensics Lab environment (VirtualBox/Workstation with Kali Linux, SIFT, etc.)

2. Convert number systems (Binary, Decimal, Hex, ASCII, Unicode) relevant to data analysis in forensics

3. Acquire disk image using `dd` and analyze file systems (FAT32, NTFS, ext4)

4. Use write blockers and create bit-stream image of removable media

5. Identify and recover deleted files using tools like Autopsy, FTK Imager, or Sleuth Kit

6. Analyze slack space, swap space and hidden files from a forensic image

7. Steganography detection and data extraction using tools like Steghide, zsteg, and binwalk

8. Investigate system logs, MAC timestamps and perform timeline analysis

9. Use NIST CFReDS sample images to perform forensic triage and evidence validation

10. Analyze email headers and extract evidence using tools like OutlookForensics or EmailTracer

11. Perform network packet capture and analysis using Wireshark or NetworkMiner

12. Forensic reporting: Generate a forensically sound report with complete Chain of Custody

13. Explore IPR, IT Act 2000 & 2008, and present case studies as an Expert Witness

14. Mini project: Simulated incident response and complete forensic investigation/report

Software/Tools Required

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Open Source: Autopsy, Sleuth Kit, Volatility, Wireshark, Kali Linux, FTK Imager (Free Version), SIFT Workstation

Proprietary (if licensed): EnCase, X-Ways, Magnet AXIOM

Hardware: Write blockers, Evidence collection kits, External storage media

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2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**CreditPoints**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CYS301	Classical Cryptography	3	0	0	3	3
2	ENGG	Major	CYS302	Computer Architecture	3	0	0	3	3
3	ENGG	Major	CYS303	Essentials of Cyber security	3	0	0	3	3
4	ENGG	Minor	CS(CYS)304	Database Management System	3	0	0	3	3
5	ENGG	Minor	IT(CYS)301	Optimization Technique	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Minor	CYS391	Classical Cryptography Lab	0	0	3	3	1
2	ENGG	Major	CYS392	Computer Architecture Lab	0	0	3	3	1.5
3	ENGG	Major	CYS393	Essentials of Cyber security Lab	0	0	3	3	1.5
4	ENGG	Major	CYS394	Database Management System Lab	0	0	3	3	1.5
5	ENGG	Major	CYS395	Introduction to Python Programming Lab	0	0	3	3	1.5
TOTAL CREDIT									**22**

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Website: www.gnit.ac.in,Email:info@gnit.ac.in

Course Name: Classical Cryptography
Course Code: CYS301
Course Type: Theory
Credits: 3 (L: 3, T: 0, P: 0)

Prerequisites

- Basic knowledge of discrete mathematics and linear algebra.
- Understanding of number systems and modular arithmetic.
- Familiarity with basic programming concepts.
- Introductory understanding of cryptographic goals (confidentiality, integrity, etc.)

Course Objectives (COBJ)

1. To understand classical encryption techniques and their cryptanalysis.
2. To explore different substitution and transposition techniques.
3. To study historical cipher systems and their mathematical foundations.
4. To analyze cipher machines like Enigma, Purple, and SIGABA.
5. To understand the working and application of stream ciphers and LFSRs.

Course Modules

Module 1: Substitution Ciphers

- Simple Substitution Ciphers
- Poly-alphabetic Ciphers
- Affine Ciphers
- Simple Substitution Cryptanalysis
- Vigenere Cipher
- Index of Coincidence

Module 2: Transposition Ciphers

- Transposition Ciphers
- Columnar Transposition
- Keyword Columnar Transposition
- Double Transposition Ciphers

Module 3: Matrix and Pad-based Ciphers

- Hill Cipher
- One Time Pad
- Code Book Ciphers

Module 4: Cryptographic Machines and Stream Ciphers

- Enigma Machine, Rotors, Enigma Attack
- Purple Machine and Decrypting Purple
- SIGABA Cipher Machine
- LFSR based shift registers
- Berlekamp-Massey Algorithm

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Course Outcomes (COs)

CO Code	Course Outcome Description
CO1	Understand and explain classical substitution and transposition ciphers.
CO2	Perform cryptanalysis on simple and poly-alphabetic substitution ciphers.
CO3	Analyze and implement matrix-based and pad-based encryption techniques.
CO4	Describe the historical cipher machines and evaluate their vulnerabilities.
CO5	Apply principles of LFSR and stream cipher algorithms in modern cryptography.

PO Mapping Table (as per NBA guidelines)

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

Mapping levels: 1 – Slight, 2 – Moderate, 3 – Substantial

Text Book / Reference
Stinson, Douglas Robert, and Maura Paterson, *Cryptography: Theory and Practice*, CRC Press, Fourth Edition, 2019.

Course Name: Computer Architecture
Course Code: CYS302
Contact: 3:0:0
Total Contact Hours: 36L
Credits: 3
Prerequisite: Digital Electronics

Course Objectives:
1. To understand the fundamental concepts of computer organization and the architectural design of modern digital computers.
2. To explore how hardware and software interact at the instruction level to execute programs.
3. To analyze the performance of different processor architectures and memory systems and memory hierarchy.
4. To study the concepts of instruction set architecture (ISA), data path design, control unit design, and pipelining.
5. To provide insights into parallelism, including instruction-level, data-level, and processor-level parallel architectures.

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

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CO2	Understand the basic structure and functionality of a CPU, including the Arithmetic Logic Unit (ALU), instruction formats, addressing modes. Analyze and apply fixed-point and floating-point arithmetic operations and IEEE 754 floating-point representation
CO2	Apply the fundamental concepts of computer architecture, including stored program organization (Von Neumann and Harvard models), instruction set and differentiate between microprogrammed and hardwired control unit designs.
CO3	Analyze memory hierarchy and mapping techniques, and performance enhancements and evaluate virtual memory concepts and page replacement policies for efficient memory management.
CO4	Evaluate pipeline execution, hazards and the techniques and explore instruction-level parallelism and evaluate the functioning of array and vector processors in achieving parallel processing.
CO5	Create the fundamentals of multiprocessor architectures, Flynn's taxonomy and analyze centralized and shared-memory systems and evaluate various interconnection networks in parallel computing systems.

Course Contents:

Module 1[8L]:
Introduction to CPU and concepts of ALU [2L], Instruction format and Instruction Cycle [1L], Addressing Modes [1L] Fixed- point multiplication -Booth's algorithm. [2L], Fixed-point division - Restoring and non-restoring algorithms [1L], Floating-point number representation-IEEE754 format and Floating-point arithmetic operation [1L].

Module 2 [7L]:
Introduction to basic computer architecture [1L], Stored Program Concepts: Von Neumann & Harvard Architecture [1L], RISC VS CISC [1L],Amdahl law [1L], Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. [2L] Micro programmed and hardwired control unit [1L].

Module 3[8L]:
Introduction to memory-RAM and ROM [1L], Register transfer, memory transfer, Tri-state bus buffer, Memory Hierarchy: Secondary memory [1L], Main Memory [1L], Cache Memory [1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [2L], Performance Implementation in Cache Memory [1L], Virtual memory Concepts [1L], page replacement policies [1L].

Module 4[9L]:
Pipelining: Basic concepts, instruction and arithmetic pipeline[2L], data hazards, control hazards and structural hazards, techniques for handling hazards[2L]Pipeline vs. Parallelism, Levels of parallelism [1L], Instruction- Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array and Vector Processors[1L]

Module 5[4L]:
Multiprocessor architecture: taxonomy of parallel architectures; Flynn Classification [1L], Centralized and Shared-memory architecture: synchronization [1L], Interconnection Network (Omega, Baseline, Butterfly, Crossbar) [2L].

Text Books:

1. Hwang - Advanced Computer Architecture Parallelism Scalability Programmability, 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.—Computerarchitectureaquantitativeapproach‖,2nd ed. Morgan Kaufman,1996
2. Hayes J. P., —Computer Architecture & Organization, McGrawHill

CO-PO Mapping

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

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

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	3
CO3	2	3	3
CO4	3	3	2
CO5	3	3	2

Course Name: Essentials of Cyber security
Course Code: CYS303
Contact (Periods/Week):3:0:0
Credit Point: 3
No. of Lectures: 36

Prerequisites:

Course Objective(s):

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks within context of the cyber security
- To learn a comprehensive overview of cyber laws and to introduce the fundamental principles and practices of cyber forensics.
- To study the defensive techniques against these attacks

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

CO1: To analyze cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and

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ultimately the entire Internet community from such attacks.
CO2: To interpret and forensically investigate security incidents.
CO3: To apply policies and procedures to manage Privacy issues.
CO4: To design and develop secure software modules.

Course Content:

Module I [6L]

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Module II [8L]

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

Module III [8L]

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security.

Module IV [8L]

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Module V [6L]

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.

Text book:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives,Wiley .

2.B.B.Gupta,D.P.Agrawal,HaoxiangWang,ComputerandCyberSecurity:Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

Reference

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

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Phone: +913325233900, Telfax: +913325637957
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CO–PO Mapping:

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

Course Name: Database Management Systems
Course Code: CS(CYS)304
Contact (Periods/Week):3:0:0
Credit Point: 3
No. of Lectures: 36

Prerequisites:

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

Course Objective(s):

- To learn the data models, conceptualize and depict a database system
- To design system using E-R diagram.
- To learn SQL & relational database design.
- To understand the internal storage structures using different file and indexing techniques.
- To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

Course Outcome(s):

After completion of the course students will be able to

CO1: To express the knowledge of data models
CO2: To implement the concept of designing an efficient relational database system
CO3: To correlate real world queries with database system.
CO4: To illustrate transaction processing, concurrency control and recovery management of a database.
CO5: To assess the internal storage structure to implement a proper database for an organization.

Course Content:
Module I :
Introduction [3L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

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Module II :
Entity-Relationship and Relational Database Model [9L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module III: [4L]
SQL and Integrity Constraints [6L]
Concept of DDL, DML, DCL. Basic Structure, set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers

Module IV :
Relational Database Design [6L]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study

Module V :
Internals of RDBMS [6L]
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

Module VI :
File Organization & Index Structures [6L]
File & Record Concept, placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text book:
1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, McGraw Hill.
2.Elmasri Ramez and Navathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing Company.

Reference
1. Jain: Advanced Database Management System Cyber Tech
2. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.

CO–PO Mapping:

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

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Course Name: Optimization Technique
Course Code: IT(CYS)301
Contact (Periods/Week):3:0:0
Credit Point: 3
No. of Lectures: 36

Prerequisites: Basic Knowledge of Function, plotting of Equation and inequations, Formulation of Mathematical Problem. Finding maximum and minimum from row or column or from Matrix.

Course Objective(s):
Purpose of this course to develop models and then analyze the model using the techniques of Operations Research, Decision making under uncertainty and risk.

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

CO1: Recall the distinctive characteristics of different types of decision-making problem to formulate and solve a real-world problem a prototype of mathematical problem.
CO2: Understand the theoretical workings of appropriate decision making approaches and tools to identify the optimal strategy in competitive world
CO3: Apply the principles of different Methods/Model of Operations Research to solve practical problems.
CO4: Analyze different engineering problems linked with Optimization Technique.

Course Content:

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

Module II [6L]
Transportation Problem, Assignment Problem

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

Module IV [5L]
Network Optimization Models: CPM PERT (Arrow network), Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities.

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

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

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

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Models, Stochastic Continuous & Stochastic Periodic Review Models.

Text book:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak
2. Nonlinear Programming by Dimitri Bertsekas
3. Operations Research by Kanti Swaroop and P.K. Man Mohan, Sultan Chand and Sons
4. Linear Programming and Theory of Games by Ghosh and Chakraborty, Central Book Agency
5. Linear Programming and Theory of Games by P.M.Karak, ABS Publishing House
6. Operations Research, D.K.Jana&T.K.Roy, Chhaya Prakashani Pvt. Ltd.
7. Operations Research, Kalavati,VIKAS 6. Operations Research,Humdy A Taha,PHI / Pearson

Reference

1. Operations Research Theory and Applications by J.K.Sharma, Macmillan India Limited.
2. Operations Research, Vijayakumar, Scitech
3. Operations Research by S.D. Sharma, Kedar Nath Ram Nath Publishers.
4. Operations Research by A.P. Verma, S. K. Kataria & Sons.
5. Operations Research by P.K. Gupta & Hira, S.Chand

CO–PO Mapping:

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

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Course: Classical Cryptography Lab
Course Code: CYS391
Course Type: Laboratory
Credits: 1 (L: 0, T: 0, P: 3)

Prerequisites

- Basic knowledge of discrete mathematics and linear algebra.
- Understanding of number systems and modular arithmetic.
- Familiarity with basic programming concepts.
- Introductory understanding of cryptographic goals (confidentiality, integrity, etc.)

Course Objectives (COBJ)

6. To understand classical encryption techniques and their cryptanalysis.
7. To explore different substitution and transposition techniques.
8. To study historical cipher systems and their mathematical foundations.
9. To analyze cipher machines like Enigma, Purple, and SIGABA.
10. To understand the working and application of stream ciphers and LFSRs.

Course Modules

- LFSR based shift registers
- Berlekamp-Massey Algorithm

Course Outcomes (COs)

CO Code	Course Outcome Description
CO1	Understand and explain classical substitution and transposition ciphers.
CO2	Perform cryptanalysis on simple and poly-alphabetic substitution ciphers.
CO3	Analyze and implement matrix-based and pad-based encryption techniques.
CO4	Describe the historical cipher machines and evaluate their vulnerabilities.
CO5	Apply principles of LFSR and stream cipher algorithms in modern cryptography.

PO Mapping Table (as per NBA guidelines)

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

Mapping levels: 1 – Slight, 2 – Moderate, 3 – Substantial

Sample Lab Programs

1. Implement a Simple Substitution Cipher and its decryption.
2. Implement Vigenere Cipher with key and frequency analysis.
3. Perform Affine Cipher encryption and decryption with a known key.
4. Create a Python program to demonstrate Columnar Transposition Cipher.
5. Encrypt a message using Hill Cipher with a 2x2 matrix key.
6. Simulate a One-Time Pad encryption system with random keys.

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7. Build a simulation of a basic Enigma Machine (3-rotor).
8. Implement LFSR (Linear Feedback Shift Register) to generate keystream.
9. Decrypt a given cipher using Index of Coincidence and frequency analysis.
10. Implement the Berlekamp-Massey Algorithm for stream cipher analysis.

Course Name: Computer Architecture Lab
Course Code: CYS392
Contact: 0:0:3
Credits: 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 CO3 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.

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.

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CO-PO Mapping

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

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

Course Name: Essentials of Cyber security Lab
Course Code: CYS393
Contact (Periods/Week): 0:0:3
Credit Point: 1.5
No. of Lectures: 36

Prerequisites: Cyber Security

Course Objective(s):

- To develop practical skills for identifying, analyzing, and mitigating common cybersecurity threats and vulnerabilities.
- To provide hands-on experience with essential cybersecurity tools for network scanning, traffic analysis, and vulnerability assessment.
- To enable students to implement encryption, authentication, and other security mechanisms for protecting data and systems.
- To train students in ethical hacking, penetration testing, and applying industry best practices for securing networks and applications.

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Course Outcome(s):

After completion of the course students will be able to

CO1 – Identify and explain common cybersecurity threats, vulnerabilities, and attack vectors through practical experimentation.
CO2 – Demonstrate the use of basic cybersecurity tools (e.g., Wireshark, Nmap, Metasploit) for network scanning, traffic analysis, and vulnerability assessment.
CO3 – Implement secure authentication, encryption, and hashing techniques to protect data in transit and at rest.
CO4 – Perform penetration testing and apply ethical hacking principles within a controlled lab environment.
CO5 – Analyze and interpret logs, alerts, and reports to detect and respond to security incidents.

Course Content:

- Writing simple Python scripts for tasks like string manipulation, reading from and writing to files, basic network communication.
- Implementing basic encryption and decryption algorithms in Python Caesar cipher, AES, DES
- Using python to generate and verify hashes (MD5, SHA-256) for files and messages.
- Building a simple Python Client-Server application, understanding sockets.
- Writing a python script to capture and analyze network packets (using libraries like Scapy or PySpark
- Creating a web scraper in Python to gather data from websites (using BeautifulSoup, Selenium)
- Simple penetration testing tasks using Python (Eg: port scanning, vulnerability scanning with tools like Nmap in Python.
- Using python to interact with security-related APIs (eg.VirusTotal, Shodan) Writing python scripts for basic static malware analysis (file signature analysis, string extraction).
- Developing a simple IDS using Python

Text book:

1**William Stallings**, *Network Security Essentials: Applications and Standards*, 7th Edition, Pearson, 2023.Covers fundamental cybersecurity concepts, cryptography, and network protection techniques—well-suited for lab reference.
2.**Dafydd Stuttard and Marcus Pinto**, *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*, 2nd Edition, Wiley, 2011.

Reference

1. **Charlie Kaufman, Radia Perlman, and Mike Speciner**, *Network Security: Private Communication in a Public World*, 2nd Edition, Pearson, 2016.
2.Patrick Engebretson, *The Basics of Hacking and Penetration Testing*, 2nd Edition, Syngress/Elsevier, 2013.

CO–PO Mapping:

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

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO4	3	–	2	3	–	3	–	2	–	–	–	3	2	3
CO5	2	3	2	2	–	2	2	–	–	–	–	3	3	3
CO6	3	2	3	3	3	2	3	2	–	–	–	3	3	3

Course Name: Database Management Systems Lab
Course Code: CYS394
Contact (Periods/Week): 3:0:0
Credit Point: 1. 5
No. of Lectures: 36

Prerequisites:

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

Course Objective(s):

- To learn the data models, conceptualize and depict a database system
- To learn the fundamental concepts of SQL queries.
- To understand the concept of designing a database with the necessary attributes.
- To know the methodology of Accessing, Modifying and Updating data & information from the
- Relational databases.
- To learn database design as well as to design user interface and how to connect with the database.

Course Outcome(s):

After completion of the course students will be able to

CO1: To understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.
CO2: To understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.
CO3: To differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
CO4: To analyze database system concepts and apply normalization to the database.
CO5: To apply and create different transaction processing and concurrency control applications.

Course Content:

Module I : [3L]

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Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys) and apply the normalization techniques.

Module II : [6L]
Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables.

Module III: [3L]
Practicing DML commands- Insert, Select, Update, Delete

Module IV : [6L]
Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc., Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer nd Equi).

Module V : [6L]
Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping, Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, updating using trigger

Module VI : [6L]
Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure, PL/SQL, Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

Module VII : [6L]
Introduction to NoSQL & Cassandra Architecture, Data Model Fundamentals & Physical Storage, Replication, Consistency, and Fault Tolerance, Querying Cassandra (CQL) & Best Practices, Internal Working & Performance Optimization

Text book:
1. SQL, PL/SQL by Ivan Bayross, BPB Publications
2. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence; Pramod J. Sadalage, Martin Fowler; Addison-Wesley

CO–PO Mapping:

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

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Course Name: Introduction to Python Programming Lab
Course Code: CYS395
Contact (Periods/Week): 0:1:3
Credit Point: 2.5
No. of Lectures: 36

Prerequisites: Knowledge of Mathematics and basic concepts of Programming

Course Outcome(s):
After completion of the course students will be able to
CO1: Understand basic of Python Programming Language
CO2: Understand the use of Conditional statement and Loops
CO3: Learn functions in python and represent collection type data using List and Dictionary
CO4: Read and write data from & to files in Python
CO5: Understand Numpy array and numerical operations on Numpy array.

Course Contents:
1. Basics of Python: Python Installation, Python variables, data types and Operator.
2. Loops: While and For loops, Python Syntax, Colon & Indentation, Conditional Statements: if, elseif and else.
3. Functions: Defining Functions in python; passing arguments.
4. String: Python Programming to explore string functions
5. Lists: Python programs using Lists; understand the use of List methods, Slicing on List.
6. Sets: Working with Sets; Write programs to show different set operations.
7. Dictionary: Demonstrate the use of Dictionaries
8. File handling: Reading & Writing data from a file, Redirecting output streams to files.
9. Basics of Module & Package: Creation, Updation, Deletion.
10. Numpy: Numerical operations using NumPy array; slicing numpy array; stacking numpy arrays; Write programs to show different numerical operations on NumPy array;.
11. Pandas: Numerical operations using Pandas array; slicing Pandas array; stacking Pandas arrays; Write programs to show different numerical operations on Pandas;.

Text book:
1. Zed A. Shaw, ADDISON-WESLEY, “Learn Python The Hard Way”.
2. Introduction to Computing & Problem Solving With PYTHON, Jeeva Jose, Khanna Publishing House.

Reference
1. Learning Python, Mark Lutz, O’REILY.
2. Programming In Python, Dr. Pooja Sharma, BPB.
3. Python Programming - Using Problem Solving Approach, Reema Thareja, OXFORD UNIVERSITY PRESS.

CO-PO Mapping:

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

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2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credit points
					L	T	P	Total	
THEORY									
1	ENGG	Major	CYS401	Machine Learning	3	1	0	4	4
2	ENGG	Major	CYS402	Computer Networks	3	0	0	3	3
3	ENGG	Major	CYS403	Ethical Hacking	3	0	0	3	3
4	HUM	Major	CYS404	Operating System	3	0	0	3	3
5	SCI	Minor	M(CYS)401	Probability and Statistics	3	0	0	0	3
B.PRACTICAL									
1	ENGG	Major	CYS491	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	Major	CYS492	Computer Networks Lab	0	0	3	3	1.5
3	ENGG	PRJ	CYS493	Android Application Development	0	0	3	3	1.5
4	ENGG	Minor	CYS494	Operating System Lab	0	0	3	3	1.5
TOTALCREDIT									**22**

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Phone: +913325233900, Telfax: +913325637957
Website: www.gnit.ac.in,Email:info@gnit.ac.in

Course Name: Machine Learning
Course Code: CYS 401
Contact (Periods/Week):3:1:0
Credit Point: 4
No. of Lectures: 48

Course Objectives

The aim of this course is to provide foundational knowledge in machine learning.

- The students will learn to implement, train and validate the machine learning models and understand the recent algorithms in machine learning through case studies.

Course Outcomes

CO1: Understand issues and challenges of machine learning: data, model selection, model complexity.
CO2: Design and implement various machine learning algorithms in a range of real-world applications.
CO3: Understand strengths and weaknesses of many popular machine learning approaches.
CO4: Analyze the underlying mathematical relationships within and across Machine Learning algorithms.
CO5: Apply the paradigms of supervised and un-supervised learning on use cases of security.

Module 1: [12L]

Supervised learning basics, Regression Vs Classification, Supervised: Linear Regression, Logistic Regression, Real-world applications, ML workflow and pipeline, Data preprocessing and feature engineering, Train-test-validation split, Overfitting and regularization, Evaluation metrics, Decision trees and inductive bias, Bias vs Variance, Performance metrics, Perceptron, Beyond binary classification. Case study: Anomaly detection

Module 2: [8L]

Advanced supervised learning - Naive Bayes, Bayesian Belief Network, K-Nearest Neighbour, Support vector machines, Markov model, Hidden Markov Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximization, Neural Networks.

Module 3: [10L]

Unsupervised Learning: Curse of Dimensionality, Dimensionality Reduction Techniques, Principal component analysis, Linear Discriminant Analysis Clustering: K-means, Hierarchical, Spectral, subspace clustering, association rule mining. Case Study: Spam filtering /machine learning for end point protection/network protection/ Application security Dimensionality reduction (PCA).

Module 4: [4L]

Model evaluation strategies, Cross-validation techniques, Confusion matrix and ROC, Bias-variance trade-off.

Module 5: [4L]

Introduction to neural networks, Perceptron and activation functions, Feed-forward architectures,

Module 6: [10L]

Scalable machine learning, Online learning concepts, Distributed computing in ML, Semi- supervised learning, Active learning, Reinforcement learning introduction, Probabilistic graphical models, Feature representation learning, Sequence and time-series modeling, Deep learning overview, Transfer learning basics

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Text Book:

1. Tom Mitchell. Machine Learning. First Edition McGraw Hill Education; 2017.

Reference Books:

1. Christopher M Bishop. Pattern Recognition and Machine Learning. Springer 2010
2. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. Wiley, Second Edition;2007
3. Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge, Massachusetts, 2012.

CO–PO Mapping:

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

Course Name: Computer Networks

Course Code: CYS402
Contact: 3:0:0
Total Contact
Hours: 36
Credits: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and Computer Architecture.
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.

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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.

Course Contents:

Module1:

Introduction [7L]

Introduction (3L):

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

Physical Layer: [4L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module 2: Data Link Layer [9L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop- and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go- Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation.[5L] Multiple Access Protocols**:** ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching**.**[4L]

Module 3: Network Layer [10L]

IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobileIP in wireless Network. [5L]

Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing: RIP, OSPF, BGP; Routing for Mobile Hosts. [5L]

Module 4: Transport layer: [5L]

Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. [4L]
Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. [1L]

Module 5: Application Layer [5L]

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Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Text books:

1. B. A. Forouzan – ―Data Communications and Networking (3rd Ed.) ―– TMH
2. S. Tanenbaum – ―Computer Networks (4th Ed.)‖ – Pearson Education/PHI

Reference books:

1. W. Stallings – ―Data and Computer Communications (5th Ed.)‖ – PHI/ Pearson Education
2. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
3. Comer – ―Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)‖ – Pearson Education/PHI

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

Course Name: Ethical Hacking
Course Code: CYS403
Contact (Periods/Week): 3:0:0
Credit Point: 3
No. of Lectures: 36

Prerequisites: Basic knowledge of system security

Course Objective(s):

Capable of analyzing, evaluating, and enhancing the security of information systems by identifying potential threats and possible countermeasures in the field system security.

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

CO1: To understand the basics of computer based vulnerabilities.
CO2: To explore different foot printing, reconnaissance and scanning methods.
CO3: To expose the enumeration and vulnerability analysis methods.
CO4: To explore the options for network protection.
CO5: To practice tools to perform ethical hacking to expose the vulnerabilities.

Course Content:
Module I [4L]
Security and protection in operating systems - access control, auditing, trusted computing base with reference to Multics and the commercial Operating Systems Malware analysis and protection- viruses, worms and Trojans, Rootkits, Ransomware, Polymorphic malware, Malware capture and analysis using honeypots.

Module II [6L]
Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport
Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

Module III [7L]
Foot printing Concepts - Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Foot printing through Social Engineering - Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

Module IV [6L]
Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities -
Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

Module V [6L]

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers
and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

Module VI [7L]

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk
Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

Text book:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and
Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2.CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.

Reference

1. Ankit Fadia " Ethical Hacking, Second Edition, Macmillan India Ltd, 2006

CO–PO Mapping:

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

Course Name: Operating System
Course Code: CYS404
Contact (Periods/Week): 3:0:0
Credit Point: 3
No. of Lectures: 36

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

Course Objective(s):

- To understand the fundamental concepts, structure, and functionalities of operating systems, including process, memory, file, and I/O management.
- To explore process synchronization, scheduling, inter-process communication, and deadlock handling for efficient resource utilization and system performance.
- To analyze and apply various memory allocation, disk scheduling, and file system techniques used in modern operating systems.

Course Outcome(s):

After completion of the course students will be able

CO1: To understand and illustrate the structure, functions, and types of operating systems and their role in resource management.
CO2: To analyze and apply process management techniques, including scheduling, synchronization, and inter-process communication.
CO3: To evaluate memory management strategies such as paging, segmentation, and virtual memory.
CO4: To implement techniques for handling deadlocks and ensuring system reliability
CO5: To discuss the organization and management of I/O systems, disk scheduling algorithms, and file systems.

Course Content:
Module – I [3L]
Concepts of Operating System, Evolution of Operating System. Types of Operating System, Structural overview, Operating system services.

Module II [8L]
Processes: Concept of processes, transition of process states, Process Control Block, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS.
Threads: overview, benefits of threads, user and kernel level threads.
CPU scheduling: Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling), Real Time scheduling: RM and EDF.
Case Study: Inter-process communication: Message passing. Thread models.

Module III [8L]
Inter-process Communication: background, critical section problem, synchronization hardware, Peterson's Solution, The Producer Consumer Problem, Semaphores.
Classical Problems of synchronization: Reader's & Writer Problem, Dinning Philosopher Problem, Monitors.

Module IV [4L]
Deadlocks: Definition, Necessary and sufficient condition for deadlock, methods for handling deadlocks: deadlock prevention, deadlock avoidance: Banker's algorithm, deadlock detection, recovery from deadlock.

Module V [6L]
Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB. Virtual Memory: background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model.

Module VI [6L]
I/O Hardware: I/O devices, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O.
Disk Management: Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK etc), disk reliability, disk formatting, boot block, bad blocks.
File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector). Cyber Attack in Operating System

Module VII [1L]
Basic overview on Cyber-attacks in Operating Systems

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

Reference Book:
1. Dietel H. N., —An Introduction to Operating Systems‖, Addison Wesley.
2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
3. William Stallings, Operating Systems, Prentice Hall.

CO–PO Mapping:

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

COURSE NAME: PROBABILITY AND STATISTICS

COURSE CODE: M(CYS)401

CONTACT: 3:0:0

TOTAL CONTACT HOURS: 36

CREDITS: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard Mathematics.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with the knowledge of probabilistic approaches and inferential statistics.

Course Outcome(s):

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

CO1: Recall the properties related probability distribution and inferential statistics.

CO2: Explain the theoretical working of the concepts of probability distribution and inferential statistics.

CO3: Apply the appropriate mathematical tools using the concepts of probability distribution and inferential statistics in Computer Science.

CO4: Analyze the real-world problems using the underlying principles of both probabilistic and statistical approaches.

Course Content:

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

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

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

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

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

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

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

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

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

Project Domains:

1. Study of uncertainty in real world phenomena using Probability Distribution.
2. Application of Sampling Theory and Estimation of Parameters in engineering problems.
3. Application of Testing of Hypothesis in engineering problems.

Text Books:

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

Reference Books:

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

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	1	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	2	1	-	-	-	-	-	-	2	1	-	-
CO4	3	3	3	2	-	-	-	-	-	-	2	1	-	-
M(CS) 401	**3**	**2.5**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**	**1**	**-**	**1**

Course Name: Machine Learning Lab
Course Code: CYS491
Contact: 0:0:3
Credits: 1.5
Total Contact Hours: 36

Course Objective(s): This course will enable students to
- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice

Course Outcome(s): The students should be able to:

CO1: Understand the implementation procedures for the machine learning algorithms.
CO2: Design Java/Python programs for various Learning algorithms.
CO3: Apply appropriate data sets to the Machine Learning algorithms.
CO4: Identify and apply Machine Learning algorithms to solve real world problems.

List of Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Implementation of Supervised, Unsupervised learning.

5. Implementation of Reinforcement Learning.

6. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

7. Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

8. Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Dataset. You can use Python ML library classes/API.

10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

11. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

12. Implement the non-parametric Locally Weighted Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs.

CO-PO-PSO Mapping:

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

Course Name: Computer Networks Lab

Course Code: CYS492
Allotted Hours: 36L

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

Course Contents:

1. Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of

Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations.**[6L]**

2. Socket Programming using TCP and UDP **[18L]**

3. Implementing routing protocols such as RIP, OSPF.**[2L]**

4. Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS **[4L]**

5. Server Configuration: only web server (Iftime permit, Instructor can do more than that) **[6L]**

Textbooks:

1. TCP sockets in C Programs-Practical guide for Programmers By Micheal , J Donahoo and Kenneth Lcalvert.
2.Socket Programming by Raj KumarBuyaa.

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

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

Course Name: Android Application Development
Course Code: CYS493
Contact (Periods/Week): 3:0:0
Credit Point: 1.5
No. of Lectures: 18

Prerequisites: Advanced Programming and Operating System

Course Objective(s):

- This course covers the fundamentals of Android programming using the Android SDK.
- To provide and discuss various techniques and tools to develop & deploy Android Applications.
- To demonstrate various applications of Android programming and its practical implications.

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

CO1: To understand and illustrate the concepts of time and space complexity, worst case, average case and best-case complexities and the big-O notation.
CO2: To analyze and apply the design principles and concepts to various basic algorithm design viz. dynamic programming, greedy method etc.
CO3: To understand and analyze the mathematical foundation of analysis of algorithms.
CO4: To understand, illustrate and analyze the different algorithmic design strategies of a given problem.
CO5: To discuss, implement and analyze, verify the efficiency of a given algorithms using time and space complexity theory.

List of experiments:

Sr. No	Name of Experiment
1	Create "First Android Application" that will display "LDRP-ITR" in the middle of the screen in the Blue color with White background.
2	Create sample application with Check user name and password only. On successful login, go to the next screen and on failing login, alert user using Toast. Also pass username to next screen.
3	Create login application where you will have to validate Email ID (User Name). Till the username and password is not validated, login button should remain disabled.
4	Create and Login application as above. On successful login, open browser with any URL.

5	Create an application that will change color of the screen, based on selected options from the menu.
6	Create an application that will display toast (Message) on specific interval of Time.
7	Create a background application that will open activity on specific Time
8	Create an UI such that, one screen has list of all the types of Books. On selecting of any book name, next screen should show Book details like: Book name, Author Name, Publication name, images (using gallery) if available, show different colors in which it is available.
9	Using content providers and permissions, read phonebook contacts using content providers and display in list.
10	Read Messages from the Mobile Devices and Display it on the screen.
11	Create an application that will play a media file from the memory card.
12	Create an application to make Insert, Update, Delete and Retrieve operation on the database.
13	Create an application to send message between two emulators.
14	Create an application to pick up any image from the native application gallery and display it on the screen.
15	Create simple app for windows phone.
16.	Create simple app for small devices and show the performance of the device.

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

1. Pradeep Kothari, Android Application Development Black Book, Dreamtech Press; 2014

CO–POMapping:

COs	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2	PSO 3
CO1	1	-	1	2	3	-	1	-	-	-	-	1	2	2
CO2	1	-	3	3	3	-	1	-	-	-	-	2	2	3
CO3	1	-	3	3	3	-	1	-	-	-	-	2	2	2
CO4	1	-	2	3	3	-	1	-	-	-	-	3	3	3
CO5	1	-	3	3	3	-	1	-	-	-	-	3	3	3

Course Name: Operating System Lab
Course Code: CYS494
No. of Lectures: 36

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

Course Outcome(s):
After completion of the course students will be able to
CO1: Use essential Linux commands for file handling, process management, and system operations effectively.
CO2: Execute shell scripts using variables, control structures, and built-in commands.
CO3: Manipulate processes, including creation, duplication, and replacement of process images.
CO4: Implement process synchronization using System V semaphores for managing concurrent access.
CO5: Create and manage POSIX threads to build multithreaded applications using appropriate thread-handling functions.

Course Content:
1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find, sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc. Mathematical commands –expr, factor, units, Pipes (use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)
2. **Shell Programming [9P]:** Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).
3. **Process [6P]:** Starting new process, replacing a process image, duplicating a process image.
4. **Semaphore [6P]:** Programming with semaphores (use functions semget, semop, semaphore_p, semaphore_v).
5. **POSIX Threads[6P]:** Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel).

Books:

1. Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications
2. W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall
3. Sumitabha Das, UNIX concepts and applications, 4th edition, TATA McGRAW HILL

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	3	-	-	2	2	3
CO2	3	3	3	3	-	-	-	-	3	-	-	2	3	3
CO3	3	3	3	2	-	-	-	-	2	-	-	2	3	3
CO4	3	3	2	3	-	-	-	-	3	-	-	3	2	3
CO5	3	3	3	2	-	-	-	-	3	-	-	2	3	3