SYLLABUS

(With effect from 2023 -24)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2023-24)

Bachelor Degree
In

Computer Science & Engineering

III & IV Semester

Out Come Based Education
With
Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka
[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ
ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ
(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

- *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*
- *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*
- *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*
- *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

Department of Computer Science and Engineering

The Vision of the department is:

"The Department of Computer Science and Engineering shall create professionally competent and socially responsible engineers capable of working in global environment.*"*

The mission of the department is:

DM1: Enforce best practices in teaching-learning, with dedicated faculty and supportive infrastructure to impart the knowledge in emerging technologies.
{Required to create professionally competent engineers}

DM2: Improve Industry-Institute relationship for mutual benefit.
{Required to create professionally competent engineers}

DM3: Inculcate ethical values, communication and entrepreneurial skills.
{Required to create professionally competent and socially responsible engineers}

DM4: Sensitize social, legal, environmental and cultural diversity issues through professional training and balanced curriculum.
{Required to create engineers capable of working in global environment}

Program Educational Objectives (PEOs)

Graduates of the program shall

1. Ability to have Successful computer professional career in IT industry and related areas.
2. Pursue higher education in engineering or management with the focus on intensive research and developmental activities.
3. Develop their carrier as entrepreneurs in a responsible, professional and ethical manner to serve the society**.**

The National Board of Accreditation (NBA) has defined twelve Program Outcomes for Under Graduate (UG) engineering programs as listed below.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problem.
2. **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess Societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

The Under Graduate (UG) of B.E Computer Science & Engineering Program has defined **Program Specific Outcomes (PSO**) which are listed below.

PSO-1: Ability to apply problem solving skills in developing solutions through fundamentals of Computer Science and Engineering.

PSO-2: Ability to apply Analytical Skills in the field of Data Processing Systems.

PSO-3: Ability to design and develop applications through Software Engineering methodologies and Networking Principles.

Bachelor of Engineering (III –Semester)

Sl. No.	Course Code	Course Title	Teaching Department	Hrs / Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P22MA301	Transforms and Series	MA	2	2	-	3	50	50	100
2	P22CS302	Data Structures	CS	3	-	-	3	50	50	100
3	P22CS303	Computer Organization	CS	3	-	-	3	50	50	100
4	P22CS304	Digital Logic Design (Integrated)	CS	3	-	2	4	50	50	100
5	P22CS305	OOP’s with JAVA (Integrated)	CS	3	-	2	4	50	50	100
6	P22CSL306	Data Structures Laboratory	CS	-	-	2	1	50	50	100
7	P22HSMC307	Employability Enhancement Skills - III	HSMC	-	2	-	1	50	50	100
8	P22BFE308	Biology For Engineers	CS	2	-	-	2	50	50	100
9	P22NSS309	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED309	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG309	Yoga	YOGA							
Total							21			

10	P22MDIP301	Additional Mathematics – I	MA	2	2	-	0	100	-	100
11	P22HDIP307	Additional Communicative English - I	HSMC	-	2	-	0	100	-	100

Bachelor of Engineering (IV –Semester)

Sl. No.	Course Code	Course Title	Teaching Department	Hrs / Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P22MA401B	Mathematical and Numerical Technique	MA	2	2	-	3	50	50	100
2	P22CS402	Theory of Computation	CS	3	-	-	3	50	50	100
3	P22CS403	Analysis & Design of Algorithms	CS	3	-	-	3	50	50	100
4	P22CS404	Database Management System (Integrated)	CS	3	-	2	4	50	50	100
5	P22CS405	AVR Micro Controller (Integrated)	CS	3	-	2	4	50	50	100
6	P22CSL406	Analysis & Design of Algorithms Laboratory	CS	-	-	2	1	50	50	100
7	P22HSMC407B	Employability Enhancement Skills - IV	HSMC	-	2	-	1	50	50	100
8.	P22INT408	Internship – I	XX	-	-	-	2	-	100	100
9.	P22NSS409	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED409	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG409	Yoga	YOGA							
Total							21			

10	P22MDIP401	Additional Mathematics – II	MA	2	2	-	0	100	-	100
11	P22HDIP407	Additional Communicative English - II	HSMC	-	2	-	0	100	-	100

TRANSFORMS AND SERIES

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22MA301**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

1	**Understand** the concept of infinite series; learn and apply Fourier series to represent periodical physical phenomena in engineering analysis.
2	To facilitate students to study, analyse and apply various transforms to solve engineering problems.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Infinite Series:** Introduction, convergence, divergence and oscillation of a series, Tests for convergence – Comparison test, Ratio test, Cauchy's root test Raabe's test, (All tests without proof)- Problems. **Self-study component:** Integral Test, Alternating series, Leibnitz's theorem – absolute and conditional convergence.	06	02
II	**Fourier Series:** Introduction, periodic function, even and odd functions, Dirichlet's conditions, Euler's formula for Fourier series (no proof). Fourier series for functions of arbitrary period of the form 2L (all particular cases) – problems, analysis- Illustrative examples from engineering field. Half Range Fourier series- Construction of Half range cosine and sine series and problems. Practical harmonic analysis-Illustrative examples from engineering field. **Self study**: Complex Fourier series.	06	02
III	Laplace Transforms: **Definition – Transforms of elementary functions. Properties of Laplace Transforms- linearity, Change of scale, shifting, Transform of Derivative and Integrals, Transform of a function multiplied by t^n and division t (no proof)-Problems, Transforms of periodic function, unit step function (All results without proof)-Problems only.** **Inverse Laplace Transforms: Evaluation of inverse transforms by standard methods. Convolution theorem - Problems only.** **Self-study component**- Transform of Unit impulse function. Solution of ODE by Laplace method and L-R-C circuits.	06	02
IV	**Fourier Transforms**: **Complex Fourier Transform**: Infinite Fourier transforms and Inverse Fourier transforms. Properties of Fourier Transforms-linearity Change of scale, shifting and modulation (no proof)-Problems, Fourier sine and cosine transforms and Inverse Fourier cosine and sine transforms with properties-Problems Convolution theorem and Parseval's identity for Fourier Transform (no proof)-problems. **Self study**: Fourier integrals- Complex forms of Fourier integral.	06	02

V	**Z-Transforms**: Definition. Some standard Z-transforms. Properties-linearity, Damping, Shifting, multiplication by *n*, initial and final value theorem-problems. Evaluation of Inverse Z- transforms- problems. **Application to Difference Equations**: Solutions of linear difference equations using Z- transforms. **Self study**: Convolution theorem and problems, two sided Z-transforms.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:	
CO1	**Understand** the fundamental concepts of infinite series, transforms of functions
CO2	**Apply** series and transform techniques to obtain series expansion, discrete and continuous transformation of various mathematical functions.
CO3	**Analyze** various signals using series expansions and differential, integral and difference equations using transforms
CO4	**Evaluate** indefinite integrals, differential equations and difference equations subject to initial conditions using transforms and develop series for a discontinuous function

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education, 11th Ed.,
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

DATA STRUCTURES

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - III

Course Code:	**P22CS302**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- To become familiar with the concept of pointers and its usage in data structure.
- To study and understand the representation and implementation of linear & non-linear data structures.
- To identify the appropriate data structure while solving real-time applications.

UNIT – I	**8 Hours**

Pointers: Review of pointers, Pointers and arrays, Arrays of pointers.

Structures: Arrays of Structures, Structures and Functions- Passing Individual Members, Passing the Entire Structure, Passing Structures through Pointers, Self-referential Structures.

Introduction: Basic Terminology-Elementary Data Structure Organization, Classification of Data Structures, Operations on Data Structures, Abstract Data Type.

Dynamic memory Allocation

Self-study component:	Examples of Abstract Data Type Static v/s Dynamic memory allocation Pointers and Two-dimensional Arrays

UNIT – II	**8 Hours**

Linked Lists: Introduction, Operations on lists, Singly linked lists, Circular linked lists, Doubly linked lists, Applications of linked lists - Polynomial Representation, Evaluation of polynomials

Self-study component:	Doubly circular linked lists, Header linked list

UNIT – III	**8 Hours**

Stacks: Introduction to Stacks, Operations on a Stack (Using Arrays & Linked list), Applications of Stacks: Implementing Parentheses Checker, Conversion of Expression: infix to postfix, Postfix to Prefix, Evaluation of Expressions: prefix expression, postfix expression.

Self-study component:	Multiple stacks Conversion of Expressions: infix to prefix, Prefix to postfix, prefix to infix, Postfix to infix

UNIT – IV	**8 Hours**

Recursion: Introduction, Factorial of a number, Fibonacci series, Tower of Hanoi, GCD of two numbers.

Queues: Introduction to Queues, Operations on Queue (Using Arrays & Linked list).

Types of Queues: Circular queue, DeQues , Priority Queue, Multiple Queues

Self-study component:	Types of recursion with examples (Linear Search, Binary Search) Applications of Queues: Josephus Problem

UNIT – V	**8 Hours**

Trees: Introduction, Basic Terminology, Types of Trees, Traversing a Binary Tree, Applications of Trees, Binary Search Trees, Operations on Binary Search Trees, Threaded Binary Trees.

Self-study component:	Huffman tree, Expression Trees.

COs	**Course Outcomes** with ***Action verb*** for the Course topics
CO1	**Apply** the concepts of pointers in data structures.
CO2	**Analyze** and represent various data structures and its operations.
CO3	**Design** algorithms using different data structures like List, Stack, Queue and Trees.
CO4	**Develop** programs with suitable data structure based on the requirements of the real-time applications.

Text Book(s):

- ReemaThareja, “Data Structures using C”, 2nd Edition,2018, Oxford University Press

Reference Book(s):

- Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, “Data Structures using C”, 2014, low price edition ,Pearson education,.
- Seymour Lipschutz ,”Data Structures with C (Schaum's Outline Series)” , July 2017, McGraw Hill Education

Web and Video link(s):

- Data Structures and algorithms offered by NPTEL: https://nptel.ac.in/courses/106102064/

E-Books/Resources:

https://www.academia.edu/28758384/

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Apply** the concepts of pointers in data structures.	3												2		
CO2	**Analyze** and represent various data structures and its operations.	2	3											2		
CO3	**Design** algorithms using different data structures like List, Stack, Queue and Trees.	2	3	3										2		
CO4	**Develop** programs with suitable data structure based on the requirements of the real-time applications.	1	1	2									1	2		

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22CS303**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Conceptualize the basics of Organizational issues of a digital computer and compare the performance of machine instruction.
- Expose different ways of communication with I/O Devices.
- Notice how to perform computer arithmetic operation.
- Understand working of processing unit using different bus structures.
- Illustrate different Types of memory devices with their principles.

UNIT – I — 8 Hours

BASIC STRUCTURE OF COMPUTERS: Basic operational Concepts, Performance.

INSTRUCTION SET ARCHITECTURE: Memory Location and Addresses, Memory Operations, Instruction and Instruction Sequencing, Addressing Modes, Assembly Language.

Self-study component: Functional Units of Computer, Number Representation and Arithmetic Operations, Character representation.

UNIT – II — 8 Hours

INSTRUCTION SET ARCHITECTURE (Continued): Subroutines, Additional instructions.

BASIC INPUT/OUTPUT: Accessing I/O Devices- I/O Device Interface, Program Controlled I/O, Interrupts-Enabling and Disabling Interrupts, Handling Multiple Devices, Exceptions.

INPUT/OUTPUT ORGANIZATION: Bus Structure, Bus Operation -Synchronous Bus, Asynchronous Bus, Arbitration.

Self-study component: Stacks, Interface Circuits.

UNIT – III — 8 Hours

MEMORY SYSTEM: Basic Concepts, Semiconductor RAM Memories, Memory Hierarchy, and Cache Memories – Mapping Functions.

Self-study component: Read Only Memories, Direct Memory Access

UNIT – IV — 8 Hours

BASIC PROCESSING UNIT: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control

Self-study component: CISC Style Processors.

UNIT – V — 8 Hours

ARITHMETIC: Multiplication of Signed Numbers, Fast Multiplication-Bit Pair Recoding of Multipliers, Carry-Save Addition of Summands, Integer Division, Introduction to Floating point Numbers and Operations.

Self-study component: Design of Fast Adders, Multiplication of Unsigned numbers.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics.
CO1	**Understand** the operation and organization of a digital computer system.
CO2	**Apply** the knowledge of assembly language / algorithmic techniques to solve the given problem.
CO3	**Analyze** the given assembly language code snippet.
CO4	**Design** memory modules.

Text Book(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization and Embedded Systems, 6th Edition, Tata McGraw Hill.

Reference Book(s):

1. Computer Organization & Architecture, William Stallings, 9th Edition, PHI, 2013.
2. Computer Systems Design and Architecture, Vincent P. Heuring& Harry F. Jordan, 2nd Ed. Pearson Education, 2004.

Web and Video link(s):

1. https://nptel.ac.in/courses/106/103/106103068/
2. https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf
3. https://nptel.ac.in/courses/106/105/106105163/
4. https://nptel.ac.in/courses/106/106/106106092/
5. https://nptel.ac.in/courses/106/106/106106166/
6. http://www.nptelvideos.in/2012/11/computer-organization.html

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Understand** the operation and organization of a digital computer system.	2														
CO2	**Apply** the knowledge of assembly language / algorithmic techniques to solve the given problem.	2	2	1										1		
CO3	**Analyze** the given assembly language code snippet.	2	2	1										1		
CO4	**Design** memory modules.	2	2	2										2		

DIGITAL LOGIC DESIGN

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22CS304**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand Boolean laws and minimization techniques and fundamental gates
- Design of combinational logic circuits using minimum number of gates, Decoders and Multiplexers
- Understand the Sequential logic components and Design of sequential circuits
- Understand and use high-level hardware description languages (VHDL) to design combinational / sequential circuits
- Conduct and Simulate practical experiments of combinational and sequential circuit

UNIT – I		**8 Hours**

Boolean Algebra: Introduction, Logic gates , Boolean Laws, Duality, Boolean expression in standard SOP and POS , Realization using basic gates and universal gates.

Minimization Of Switching Functions: Introduction, K-Map: Two-variable, Three-variable and ,Four-variable K-map, Don't care combinations**,** Map entered variable(VEM), Limitation of K-map, Code converters: Binary to gray **,** BCD to Excess 3 **,** Quine-Mc-Clusky method- 3 variable

Self-study component:	Quine-Mc-Clusky method- 4,5 variable
Practical Topics: **(6 Hours)**	Verify the truth table for different logic gates using IC's 1. A committee of three individuals decides issues for an organization. Each individual votes either yes or no for each proposal that arises. A proposal is passed if it receives at least two yes votes. Design a circuit using minimum number of NAND gates only that determines whether a proposal passes. 2. Design Logic circuit to convert 3 bit binary to gray code using basic gates.

UNIT – II		**8 Hours**

Combinational Logic Design: Introduction to combinational circuits, Adders, Subtractors, ripple carry adder, Look ahead carry adder, Comparators:1-bit and 2bit magnitude comparator, Encoders: octal to Binary and Decimal to BCD encoder, Priority encoders, Decoders: 2 to 4, 3 to 8 line decoder, Multiplexers: 2:1,4:1, 8:1,16:1 , Design combinational circuits using Decoders and Multiplexers

Self-study component:	7 Segment Decoder , Demultiplexer
Practical Topics: **(6 Hours)**	1. Design Full adder using suitable Decoder 2. A lawn sprinkling system is controlled automatically by certain combinations of the following variables.

	Season(S=1,if summer; 0, otherwise) Moisture content of soil(M=1,if high;0 if low) Outside temperature(T=1, if high;0 if low) Outside humidity(H=1,if high;0 if low) The sprinkler is turned on under any of the following circumstances: i. The moisture content is low in winter. ii. The temperature is high and the moisture content is low in summer. iii. The temperature is high and the humidity is high in summer. iv. The temperature is low and the moisture content is low in summer. v. The temperature is high and the humidity is low. Implement using suitable multiplexer.(use 8x1 mux)	
UNIT – III		**8 Hours**
Introduction to Sequential Circuits: Classification of sequential circuits: Asynchronous and Synchronous, NAND and NOR latches and flip flops: Excitation tables, State diagram and Characteristic equation of SR, JK, Race around condition, Master slave JK flip flops, , Excitation tables, State diagram and Characteristic equation of D and T flip flops, Conversion of SR to JK, JK to D, T to D Flip flops		
Self-study component:	Conversion of JK to SR, D to JK and D to T Flip flops	
Practical Topics: **(4 Hours)**	Verify the truth table of JK and D Flip Flops 1. Implement Master slave D Flip Flop using only NAND Gates 2. Design and demonstrate the conversion of JK flip flop to T Flip Flop	
UNIT – IV		**8 Hours**
Introduction to Shift Registers and Counters**:** Data Transmission In Shift Registers, Serial In Serial Out Shift Register, Serial In Parallel Out Shift Register, Parallel In Serial Out Shift Register, Parallel In Parallel Out Shift Register, Design of shift registers using JK and D flip Flop's, Application Of Shift Registers: Ring Counter , Johnson Counter Up/Down Synchronous and Asynchronous Introduction, Design counters using JK and T Flip flip		
Self-study component:	Effects of propagation delay in ripple counters, Sequence detector design	
Practical Topics: **(4 Hours)**	1. Design and demonstrate 3-bit serial in serial out shift register using D Flip Flop's 2. Design and demonstrate 2-bit synchronous counter for the given sequence using JK Flip Flop.	
UNIT – V		**8 Hours**
Hardware description languages, VHDL description of combinational circuits, VHDL models for multiplexers, VHDL modules, Sequential statements and VHDL processes, Modeling Flip-flops using VHDL Processes, VHDL Modeling registers and counters using VHDL processes		
Self-study component:	Compilation, simulation and synthesis of VHDL code, Simple synthesis examples.	

Practical Topics: **(4 Hours)**	Write the VHDL code for basic gates and verify its working 1. Write the VHDL code for 8:1 Mux .Simulate and verify it's working. 2. Write the VHDL code for JK and D flip-flop. Simulate and verify it's working. 3. Write the VHDL code for 3- bit synchronous down counter. Simulate and verify it's working.
NOTE	These experiments are for Practice **Practical Topics** will be changed every academic year

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Apply** Boolean Algebra/ K Map and knowledge of fundamental gates in minimizing Logic function
CO2	**Analyze** Combinational and Sequential circuits
CO3	**Design** Combinational /Sequential logic circuit for the given problem
CO4	**Develop** VHDL code for Combinational / Sequential logic circuit
CO5	**Conduct** and Simulate practical experiments for demonstrating the working of Combinational and Sequential circuit both with component realization and VHDL code

Text Book(s):

1. A. Anand Kumar, Fundamentals of Digital Circuits,4th Edition, PHI Learning, ISBN: 9788120352681,Nov- 2016
2. Charles H.Roth, Jr., Lizy Kurian John, Digital Systems Design using VHDL,2nd Edition, CENGAGE Learning,2012

Reference Book(s):

1. M.Morris Mano, Michael D.Ciletti, Digital Design with an introduction to the verilog HDL, VHDL and systemverilog,6th edition, Pearson Publication,2020
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and applications,8th edition, McGraw-Hill Education,2017

Web and Video link(s):

1. https://nesoacademy.org/ec/05-digital-electronics

E-Books/Resources:

1. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf
2. https://drive.google.com/file/d/1lw9LhePHIhwBljiWSXrmEJgXj5RE05j4/view?usp=sharing

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Apply** Boolean Algebra / K Map and knowledge of fundamental gates in minimizing Logic function	3												1		
CO2	**Analyze** Combinational and Sequential circuits	1	3	1										1		
CO3	**Design** combinational /sequential logic circuit for the given problem	1	2	3										1		1
CO4	**Implement** Combinational/ Sequential logic circuit **using VHDL code**	1	1	2										1		
CO5	**Conduct** and Simulate practical experiments for demonstrating the working of combinational and sequential circuit both with component realization and VHDL code	1	1	2	1	2				2				1		

OBJECT ORIENTED PROGRAMMING WITH JAVA (Integrated)

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22CS305**	**Credits:**	**4**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: The students will be able to

- Understand fundamentals of Object Oriented Concepts.
- Explore the features of Object-oriented Programming in Java for defining classes, methods and invoking methods.
- Write program in Java to solve specified problems.

UNIT – I	**8 Hours**

Object Oriented Concepts : Fundamentals of Object Oriented programming - Object oriented paradigm, basics concepts of object oriented programming, benefits of object oriented programming, applications of object oriented programming.

JAVA Basics: JVM architecture. The scope and life time of variables, control statements, type conversion and casting, simple java programs.

Self-study component:	Data types and operators
Practical Topics: **(6 Hours)**	1. Accept N numbers and find their sum. Check whether the sum is prime or not. 2. Evaluate the following series using switch statement a) a + 2a/b + 3a/2b + ... +na/(n-1)b b) 1 + ½ + ¼ + 1/8 + ... 3. To read a string and the two index values (i and j). Extract the string from i^{th} position to j^{th} position

UNIT – II	**8 Hours**

Classes, Objects and Methods: Class Fundamentals, How objects are created, Reference variables, methods, Returning from a method returning, Returning a value, Constructors, Parameterized constructors, this keyword, Java access modifiers, Passing objects to methods, How augment are passed, Returning Objects, Method overloading, Overloading constructors, Static-variables, methods and blocks, Nested and Inner class, Variable length arguments basics.

Self-study component:	Arrays
Practical Topics: **(6 Hours)**	1. Create a Java class called Complex with the following details and variables within it as (i) Real (ii) Imaginary Develop a Java program to perform addition and subtraction of two complex numbers by using the method add() and subtract( ) respectively by passing object as parameter and display result using method display(). Initialize the real and imaginary values of the complex number using parameterized constructor.

<table>
<tr><td></td><td colspan="2">2. A class called MyTime, which models a time instance with private instance variables: hour: between 0 to 23, minute: between 0 to 59, constructor shall invoke the setTime() method to set the instance variable (setTime(int hour, int minute): It shall check if the given hour and minute are valid before setting the instance variables).
define methods - getHour(), getMinute(),
nextMinute()Update this instance to the next minute and return this instance. Take note that the nextMinute() of 23:59 is 00:00
nextHour() is similar to the above.
Write the code for the MyTime class. Also write a test program (called TestMyTime) to test all the methods defined in the MyTime class.</td></tr>
<tr><td colspan="2"><b>UNIT – III</b></td><td><b>8 Hours</b></td></tr>
<tr><td colspan="3"><b>Inheritance:</b> Inheritance basics<b>,</b> Member access and inheritance, Constructors and Inheritance, Using super to call super class constructor, Using super to access super class members, Creating a multilevel hierarchy, Execution of constructors, Super class reference and Subclass objects, Method overriding, Abstract class.</td></tr>
<tr><td><b>Self-study component:</b></td><td colspan="2">Using final</td></tr>
<tr><td><b>Practical Topics:</b>
<b>(4 Hours)</b></td><td colspan="2">1. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. Create a class Account that stores customer name, account number and type of account. From this derive the classes Curr-acct and Sav-acct to make them more specific to their requirements. The savings account provides compound interest and withdrawal facilities. The current account does not provide interest. Current account holders should also maintain a minimum balance (Rs 5000) and if the balance falls below this level, a service charge (Rs 100) is imposed. Include the necessary methods in order to achieve the following tasks:
 Accept deposit from customer and update the balance.
 Display the balance.
 Compute and deposit interest
 Permit withdrawal and update the balance
 Check for the minimum balance (only for Current account), impose penalty if necessary and update the balance.
2. Design a base class Circle with member variables (radius of type double and color of type character), methods (getRadius(), getArea()) and constructors (Circle(radius), Circle(radius, color)).
Derive subclass called Cylinder from the super class Circle with member variable (height) of type double, public methods (getHeight(), getVolume(), getArea()) and constructors(Cylinder(height),Cylinder(height,radius),Cylinder(height, radius, color)). Create the two instances of cylinder and print similar cylinders if the area, volume and color of cylinders are same.</td></tr>
</table>

	Demonstrate the code reuse and polymorphism properties of Object oriented programming by inheriting the constructors and methods of the base class. Derive subclass called Cylinder from the superclass Circle with member variable (height) of type double, public methods (getHeight(), getVolume(), getArea()) and its constructors(Cylinder(height, radius), Cylinder(height, radius,color)). Create the two instances of cylinder and print similar cylinders if the area, volume and color of cylinders are same. Demonstrate the code reuse and polymorphism properties of Object oriented programming by inheriting the constructors and methods of the base class.	
UNIT – IV		**8 Hours**
Interface: Interface fundamentals, Creating an interface, Implementing an interface, Using interface references **Packages:** Fundamentals of packages, Packages and member access, Importing packages. **Multithreaded Programming:** The Java thread model, Creating a thread, Creating multiple threads, Using isalive() and Join( ), Thread priorities.		
Self-study component:	Constants in Interfaces, Nested Interfaces	
Practical Topics: **(4 Hours)**	1. Create an interface with name encryption and members as message and encrypt(). Derive two classes from this interface namely Nextchar and Prevchar In Nextchar class implement the method encrypt() to replace each character by its next character. In Prevchar class implement the method encrypt() to replace each character by its previous character. For example: 1. If the input is “college” then the output is “dpmmfh” (replace each character by next characher). If the input is zebra then the output is “ydaqz” (replace each character by previous character). 2. Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class internals has an array that stores the internal marks scored in six courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array that stores the SEE marks scored in six courses of the current semester of the student. Import the two packages in a file that declares the final marks of N students in all six courses. 3. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number	

UNIT – V	8 Hours

Exception handling: Fundamentals, Exception hierarchy, uncaught exceptions, using try and catch, multiple catch clauses, throw, finally, Java's built-in exceptions.

Generics: generic fundamentals, bounded types, generic methods, generic constructors, generic class hierarchies.

Self-study component:	Generic interfaces, throws
Practical Topics: **(4 Hours)**	1. Write a java program to handle the following exceptions based on choice made by the user by writing suitable try and catch block. i) ArithmeticException ii) ArrayIndexOutOfBoundsException iii) NumberFormatException iv) StringIndexOutOfBoundException v) NullPointerException 2. Define a class Sort with generic method by name Arrange(T[]) and Display(T[]). Write a program to sort array elements of different data types.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics.
CO1	**Understand** and explore the fundamental concepts of object oriented programming language.
CO2	**Apply** the syntax and semantics of java for solving a given problem.
CO3	**Analyze** the given Java code snippet to identify the bugs and correct the code.
CO4	**Conduct** experiments using IDE to demonstrate the features of Java programming language.

Text Book(s):

1. Herbert Schildt and Dale Skrien, "Java Fundamentals – A comprehensive Introduction", McGraw Hill, 1st Edition, 2013.
2. Programming with Java A Primer E. BalaGuruSwamy 5th Edition McGraw Hill Education 2014

Reference Book(s):

1. The Complete Reference - Java , Herbert Schildt , 11th Edition , 2019, McGraw Hill Education Publications.Core Java
2. Core Java – Vol 1, Cay S Horstmann, Gary Cornell 11th Edition Prentice Hall. 2018.

E-Books/Resources:

1. Java Programming Wikibooks Contributors Seventh Edition wikibooks.org 2016 URL:https://upload.wikimedia.org/wikipedia/commons/e/e7/Java_Programming.pdf
2. Java Programming,WikibooksContributors, Seventh Edition, wikibooks.org 2016,URL https://upload.wikimedia.org/wikipedia/commons/e/e7/Java_Programming.pdf

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Understand** and explore the fundamental concepts of object oriented programming language.	**2**														
CO2	**Apply** the syntax and semantics of java for solving a given problem.	**2**	**2**	**2**										1		
CO3	**Analyze**the given Java code snippet to identify the bugs and write correct code.	**2**	**2**	**1**										1		
CO4	**Conduct** experiments using IDE to demonstrate the features of Java programming language**.**	**2**	**2**	**2**		**2**				**1**			1	1		

Data Structures Laboratory

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22CSL306**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Lab Hours:	**24**	**SEE Marks:**	**50**

Note: All programs are to be implemented using C Language

1. Create a structure **DISTANCE** with data members ***kms*** and ***meters***.
   Implement a program using function to perform addition and subtraction on two distances by passing pointer to a structure.
2. Implement a menu driven program to perform the following operations on Singly Linked List.
   (i) Create SLL of 'n' nodes of integers (insert front/rear)
   (ii) Delete the node with specified integer from the list with appropriate message.
   (iii) Display the contents of the SLL.
3. Implement a menu driven Program for the following operations on Doubly Linked List (DLL) of Library Data with the fields: BOOK_ID, BOOK_TITLE, AUTHOR, EDITION
   (i) Create a DLL of 'N' books (Insert front/rear).
   (ii) Count the number of nodes in the DLL.
   (iii) Delete the node at front/rear.
   (iv) Display the contents of DLL.
4. Implement a menu driven Program for the following operations on Circular Linked List.
   (i) Create CLL with information field of type string
   (ii) Count the number of nodes in the CLL.
   (iii) Delete the node at front/rear.
   (iv) Display the contents of CLL.
5. Implement a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
   (i) Push an Element on to Stack (Handle the situation of overflow)
   (ii) Pop an Element from Stack (Handle the situation of underflow)
   (iii) Display the contents of Stack
6. Implement a Program to convert an infix expression to its equivalent postfix expression.
7. Implement the following using recursion:
   (i) Tower_of_Hanoi
   (ii) GCD of two numbers
   (iii) Largest of 'n' numbers
8. Implement a menu driven Program for the following operations on QUEUES of Strings using Linked list
   (i) Insert an Element into Queue
   (ii) Delete an Element from Queue
   (iii) Display the contents of Queue
9. Implement a menu driven program to perform the following operations on priority queue using linked list.

	(i) Insert a node based on priority. (ii) Delete a node from the queue (iii) Display the contents of the queue
10.	Implement a menu driven Program to perform the following operations on Binary Search Tree (BST) (i) Create a BST of N Integers (ii) Tree Traversals methods

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Design** algorithms using different data structures like List, Stack, Queue and Trees.	2	2	2										2		
CO2	**Develop** programs with suitable data structure based on the requirements of the real-time applications.	2	2	2									1	2		

EMPLOYABILITY ENHANCEMENT SKILLS - III

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22HSMC307**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving percentages, profit & loss and discounts.
- Explain concepts behind logical reasoning modules of direction sense and blood relations.
- Prepare students for Job recruitment process and competitive exams.
- Develop Problem Solving Skills.
- Apply programming constructs of C language to solve the real-world problem.

UNIT – I		**06 Hours**

Quantitative Aptitude: Number System – Divisibility & Remainder, Multiples & Factors, Integers, HCF & LCM, Decimal Fractions, Surds & Indices, Simplification.

Self-study component:	Linear equations.

UNIT – II		**06 Hours**

Quantitative Aptitude: Percentages, Profits, Loss and Discounts.

Logical Reasoning: Blood Relations.

Self-study component:	Inferred meaning, Chain rule.

UNIT – III		**06 Hours**

Logical Reasoning: Direction Sense Test.

Verbal Ability: Change of Speech and Voice, Sentence Correction.

Self-study component:	Height & distance.

UNIT – IV	**C-PROGRAMMING - I**	**06 Hours**

Introduction: Keywords and Identifier, Variables and Constants, Data Types, Input/Output, Operators, Simple Programs.

Flow Control: If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs.

Functions: Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs

Arrays: Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.

Self-study component:	Evaluation of Expression.

UNIT – V	C-PROGRAMMING - II	06 Hours

Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples.

Strings: String Functions, String Examples, Programs.

Structure and Union: Structure, Struct & Pointers, Struct & Function, Unions, Programs.

Programming Files: Files Input/output

Self-study component:	Error handling during I/O operations.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Exhibit amplified level of confidence to express themselves in English.	Applying	L3
CO2	Solve the problems based on Number systems, percentages, profit & loss and discounts.	Analyzing	L4
CO3	Solve logical reasoning problems based on direction sense and blood relations.	Analyzing	L4
CO4	Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.	Applying	L3

Text Book(s):

1. The C Programming Language (2nd edition) by Brian Kernighan and Dennis Ritchie.
2. C in Depth by S K Srivastava and Deepali Srivastava.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Problem Solving through Programming in C - https://archive.nptel.ac.in/courses/106/105/106105171/

COURSE ARTICULATION MATRIX
(EMPLOYABILITY ENHANCEMENT SKILLS - III – P22HSMC307)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2	2	2										
CO3	2	2										
CO4	2	2								2		1

BIOLOGY FOR ENGINEERS [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III			
Course Code:	**P22BFE308**	**Credits:**	**02**
Teaching Hours/Week (L:T:P)	**2:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**25**	**SEE Marks:**	**50**

Course Learning Objectives:

The objectives of this course are to,

- Familiarize the students with the basic biological concepts and their engineering applications.
- Enable the students with an understanding of bio-design principles to create novel devices and structures.
- Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- Motivate the students to develop the interdisciplinary vision of biological engineering.

Course Content

Biomolecules And Their Applications (Qualitative): Carbohydrates (cellulose-based water filters, PHA and PLA as bio-plastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (bio-diesel, cleaning agents/detergents), Enzymes (glucose-oxidase in bio-sensors, lingolytic enzyme in bio-bleaching). **5Hrs**

UNIT-II

Human Organ Systems And Bio-Designs-1 (Qualitative): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics, Engineering solutions for Parkinson’s disease), Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). **5Hrs**

UNIT-III

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS-2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine), Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). **5Hrs**

UNIT-IV

Nature Bio Inspired Materials And Mechanisms (Qualitative): Echolocation (ultra sonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts). **5Hrs**

UNIT-V

Trends In Bio- Engineering (Qualitative): DNA origami and Bio-computing, Bio-imaging and Artificial Intelligence for disease diagnosis, Self healing Bio-concrete (based on bacillus spores, calcium lactate nutrients and bio-mineralization processes), Bio-remediation and Bio-mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). **5Hrs**

Suggested Learning Resources:

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook, 16thEdition, 2022.
- Biology for Engineers, Thyagarajan S, SelvamuruganN, Rajesh M. P, Nazeer R. A, Thilagaraj W, Barathi. S and Jaganthan M.K, Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T.Johnson, CRC Press, Taylor and Francis, 2011.
- Bio-medical Instrumentation, Leslie Cromwell, Prentice Hall, 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen,Vayu Education of India, New Delhi, 2014.
- Bio-mimetics: Nature Based Innovation,Yoseph Bar-Cohen,1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bio-remediation of heavy metals: bacterial participation, C R Sunil Kumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.
- 3D Bio-printing: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016.

Web links and Video Lectures (e-Resources):

- VTUEDUSAT/SWAYAM/NPTEL/MOOCS/Coursera/MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology

1. https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes

At the end of the course, students will be able to,

1. **Understand** the bio-design principles involved in building novel devices and structures.
2. **Elucidate** the basic biological concepts through relevant industrial/Engineering application.
3. **Apply** innovative bio based solutions solving socially relevant problems.

Course Articulation Matrix

Course Outcomes		Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Understand** the bio-design principles involved in building novel devices and structures.	2	1				1	1	1				1
CO2	**Elucidate** the basic biological concepts through relevant industrial application.	2	1				1	1	1				1
CO3	**Apply** innovative bio based solutions solving socially relevant problems.	2	2				2	2	1				2

Blooms Level	Marks Weightage	Maps Course Outcome to the Corresponding Blooms Level
Understand/Elucidate	50-60%	
Apply	35-50%	

NATIONAL SERVICE SCHEME

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - III

Course Code:	**P22NSS309/409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Pre-requisites to take this Course:

1. Students should have a service oriented mind set and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time.

Corse Objectives :National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes
5. Develop capacity to meet emergencies and natural disasters & practice national integration and
social harmony

Content

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R’s.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/
vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath,Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

AND

ONENSS – CAMP @ College /University /Stateor Central GovtLevel /NGO’s /General Social Camps Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp. CIE will be evaluated based on their presentation, approach and implementation strategies.	
Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the importance of his / her responsibilities towards society.
CO2:	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4:	Implement government or self-driven projects effectively in the field.

<table>
<tr><td colspan="4"><b>PHYSICAL EDUCATION</b>
[As per Choice Based Credit System (CBCS) & OBE Scheme]
<b>SEMESTER - III</b></td></tr>
<tr><td><b>Course Code:</b></td><td><b>P22PED309</b></td><td><b>Credits:</b></td><td><b>00</b></td></tr>
<tr><td><b>Teaching Hours/Week (L:T:P):</b></td><td><b>0:0:2</b></td><td><b>CIE Marks:</b></td><td><b>100</b></td></tr>
<tr><td><b>Total Number of Teaching Hours:</b></td><td></td><td><b>SEE Marks:</b></td><td><b>-</b></td></tr>
<tr><td>Fitness Components</td><td colspan="3" rowspan="2">Meaning and Importance, Fit India Movement, Definition of fitness, Components of
fitness, Benefits of fitness, Types of fitness and Fitness tips.
Practical Components: Speed, Strength, Endurance, Flexibility, and Agility
KABADDI
A. Fundamental skills
1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line.
2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques.
3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense.
4. Game practice with application of Rules and Regulations.
B. Rules and their interpretations and duties of the officials.</td></tr>
<tr><td>Speed
Strength
Endurance
Agility
Flexibility</td></tr>
<tr><td>Kho kho</td><td colspan="3">A. Fundamental skills
1. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul.
2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play.
3. Game practice with application of Rules and Regulations.
B. Rules and their interpretations and duties of the officials.</td></tr>
<tr><td>Kabaddi</td><td colspan="3">A. Fundamental skills
1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line.
2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques.
3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense.
4. Game practice with application of Rules and Regulations.
B. Rules and their interpretations and duties of the officials</td></tr>
</table>

YOGA

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - III

Course Code:	**P22YOG309**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:		**SEE Marks:**	**-**

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical

1. Improved body flexibility and balance
2. Improved cardiovascular endurance (stronger heart)
3. Improved digestion
4. Improved abdominal strength
5. Enhanced overall muscular strength
6. Relaxation of muscular strains
7. Weight control
8. Increased energy levels
9. Enhanced immune system

- Mental

1. Relief of stress resulting from the control of emotions

2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills

- Spiritual

1. Life with meaning, purpose, and direction
2. Inner peace and tranquility
3. Contentment

Yoga, its origin, history and development. Yoga, its meaning, definitions.
Different schools of yoga, Aim and Objectives of yoga, importance of prayer
Yogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitioner
Yoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds
Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas
a. Sitting 1. Padmasana
2. Vajrasana
b. Standing 1. Vrikshana
2. Trikonasana
c. Prone line 1. Bhujangasana
2. Shalabhasana
d. Supine line 1. Utthitadvipadasana
2. Ardhahalasana

Additional Mathematics - I [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – III (Lateral Entry: Common to all branches)**			
Course Code:	**P22MDIP301**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**
Course Learning Objectives: The mandatory learning course P21MATDIP31 viz., Additiona Mathematics-I aims to provide basic concepts of complex trigonometry, vector algebra differential & integral calculus, vector differentiation and various methods of solving first orde differential equations.			
UNIT-I			
Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems **Self-study components:** De-Moivre's theorem (without proof). Roots of complex number - Simple problems.			**12Hrs**
UNIT-II			
Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Taylors series and Maclaurin's series expansions- Illustrative examples. Partial Differentiation: Elimentary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. **Self-study components**: Review of successive differentiation. Formulae for nth derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.			**10Hrs**
UNIT-III			
Integral Calculus: reduction formulae for sin^nx, cos^nx, *and* sin^mxcos^mx and evaluation of these with standard limits-Examples. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. **Self-study components**: Differentiation under integral sign (Integrals with constants limits)-Simple problems.			**10Hrs**
UNIT-IV			
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). **Self-study components**: Solenoidal and irrotational vector fields-Problems.			**10Hrs**
UNIT - V			
Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types **Self-study components:** Applications of first order and first degree ODE's - Orthogonal trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.			**10Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the fundamental concepts –in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.
CO2:	Identify – partial derivatives to calculate rate of change of multivariate functions
CO3:	Apply - the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and indentify velocity, acceleration of a particle moving in a space
CO4:	Find analytical solutions by solving first order ODE's which arising in different branches of engineering.

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

Additional Communicative English – I

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22HDIP307**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Module-1

Introduction to Communication Skills 6 Hours

Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.

Module-2

Listening Skills I 4 Hours

Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions

Module-3

Speaking Skills I 6 Hours

Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak

Module-4

Reading Skills I 4 Hours

Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading.

Writing Skills I 4 Hours

Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story

Module-5

Body Language and Presentation Skills 6 Hours

Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations

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

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to Apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018

CO – PO – PSO Matrix

CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1												2			
CO2										2					
CO3										2					
CO4									2						
CO									**2**	**2**		**2**			

MATHEMATICAL AND NUMERICAL TECHNIQUE

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV (COMMON TO EC, EEE, CS, IS)

Course Code:	**P22MA401B**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
3	**Develop** the knowledge of Linear Algebra to solve system of equation by using matrices

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Calculus of complex functions**: Introduction to complex variables. Definitions- limit, continuity, differentiability and Analytic functions of f(z) : Cauchy- Riemann equations in Cartesian and polar forms (no proof)-Harmonic function and Problems. Applications to flow problems. Construction of analytic functions when $u\ or\ v\ or\ u \pm v$ are given- Milne-Thomson method. Conformal transformations: Introduction. Discussion of transformations for $W = z^2 , W = e^z , W = z + {}^1/_z\ where\ z \neq 0$ **Self-Study**: Derivation of Cauchy- Riemann equation in Cartesian and polar form	06	02
II	**Complex integration:** Bilinear Transformations- Problems, line integrals of complex function. Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (Statements only)- illustrative examples. Singularities, poles and residues with examples, Cauchy's Residues Theorem (statement only)- Illustrative examples. **Self-Study:**– Contour integration Type-I & Type-II problems	06	02
III	**Statistical Methods:** **Statistics:** Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. **Curve Fitting:** Curve fitting by the method of least squares, fitting the curves of the forms $= ax + b$, $y = ab^x$ $and\ y = ax^2 + bx$ + c. **Correlation and regression**: Karl Pearson's coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression and problems. **Self-Study**: **Self-Study**: Fit a curve of the form $y = ax + b, y = a + bx + cx^2$	06	02
IV	**Probability and Distribution:** **Random variables and Probability Distributions:** Review of random variables. Discrete and continuous random variables-problems. Binomial, Poisson, Exponential and Normal distributions (with usual notation of mean and variance)-:problems. **Joint Probability Distributions :** Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables **Self-study:** Geometric and Gamma distributions- problems.	06	02

V	**Stochastic Processess and sampling theory**: **Markov Chains**: Markov chains, Classification of Stochastic processes, Probability vector, Stochastic matrix, Regular stochastic matrix, Transition probabilities and Transition probability matrix. **Testing of Hypothesis**: Sampling distributions-introduction. Standard error, Type-I and Type-II errors. Testing of hypothesis and confidence intervals for means. Student's t –distribution and Chi-square distribution as a test of goodness of fit - Illustrative examples only. **Self-study**: Classification of Stochastic process, Bernoulli Process, Poisson Process.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:	
CO1	**Understand** fundamental concepts in calculus of complex functions, statistics, probability and special functions.
CO2	**Apply** tools taught to analyze transformations arising in engineering field and evaluate complex integrals and draw statistical inferences.
CO3	**Analyse** problems in engineering field by employing special functions, complex functions and statistical methods.
CO4	**Evaluate** integrals of complex functions, regression and correlation coefficient, probability of a discrete and continuous variable, series solution of special differential equations.

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International PublishingHouse Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-

tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

THEORY OF COMPUTATION
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER - IV

Course Code:	**P22CS402**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Design finite automata
- Design regular expression
- Design CFG
- Design push-down automata
- Design Turing machines

UNIT – I	**FINITE AUTOMATA**	**8 Hours**
Chomsky Hierarchy, Deterministic finite automata, Nondeterministic finite automata, Finite automata with Epsilon transitions, Application of finite automata		
Self-study component:	Extended transitions and languages for DFA,NFA and ϵ-NFA	
UNIT – II	**REGULAR EXPRESSIONS, LANGUAGES AND PROPERTIES**	**8 Hours**
Regular expressions, Finite Automata and Regular Expressions, Pumping Lemma for regular languages, Equivalence and minimization of automata, Applications.		
Self-study component:	Closure properties; Decision properties	
UNIT – III	**CONTEXT FREE GRAMMERS, LANGUAGES AND PROPERTIES**	**8 Hours**
Context –free grammars, Parse trees, Ambiguity in CFG**,**The pumping lemma for CFLs, Normal forms : Chomsky's Normal Forms ,GNF, Applications.		
Self-study component:	Closure properties of CFLs.	
UNIT – IV	**PUSHDOWN AUTOMATA**	**8 Hours**
Definition of the Pushdown automata, the languages of a PDA, Deterministic Pushdown Automata, Equivalence of PDA's and CFG's, CFG to PDA.		
Self-study component:	PDA to CFG	
UNIT – V	**TURING MACHINES**	**8 Hours**
The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines, Undecidable problem that is RE, Post's Correspondence problem.		
Self-study component:	Problems that Computers cannot solve, Turing Machine and Computers.	

COs	Course Outcomes with action verbs for the course topics
CO1	**Understand** the basic concept of Automata.
CO2	**Apply** the knowledge of Automata Theory for formal Languages
CO3	**Analyze** automata and their computational power to recognize languages
CO4	**Design an** automaton.

Text Book(s):

1. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw Hill, 2007.

Reference Book(s):

1. John E... Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson education, 2014.
2. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2004.

Web and Video link(s):

1. **https://www-2.dc.uba.ar/staff/becher/Hopcroft-Motwani-Ullman-2001.pdf**
2. **https://www.mog.dog/files/SP2019/Sipser_Introduction.to.the.Theory.of.Computation.3E.pdf**

E-Books/Resources:

1. **https://tinyurl.com/bdfst7kn**

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	**Understand** the basic concept of Automata.	3	2	1										2	2	
CO2	**Apply** the knowledge of Automata Theory for formal Languages	3	1	1										2	2	
CO3	**Analyze** automata and their computational power to recognize languages	1	3	1										2	2	
CO4	**Design** an automaton.	1	1	3										2	3	

DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code:	**P22CS403**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Prerequisites: Students should have knowledge of Programming language and Data structures.

Course Learning Objectives: This coursewill enable students to:

- Explain various computational problem-solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

UNIT - I	**8 Hours**

Introduction: Algorithm, Fundamentals of Algorithmic problem solving, Important Problem Types, Fundamental Data Structures - Graphs, Fundamentals of the **Analysis of Algorithm Efficiency**: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical analysis of Non-Recursive Algorithms with Examples [Max Element, Unique Elements]and Recursive Algorithms with Examples [Factorial, Tower of Hanoi].

Self-study component:	Additional Examples of Mathematical analysis of Non-Recursive& Recursive Algorithms.

UNIT - II	**8 Hours**

Brute Force and Exhaustive Search: Selection Sort, Brute-Force String Matching, Exhaustive Search [Travelling Salesman Problem and Knapsack Problem].**Decrease and Conquer**: Introduction, Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.

Self-study component:	Bubble Sort and Sequential Search.

UNIT - III	**8 Hours**

Divide and Conquer: Merge sort, Quick Sort, Multiplication of Large integers and Strassen' Matrix Multiplication. **Transform and Conquer**: Pre sorting, Balanced Search Trees, Heaps and Heap sort.

Self-study component:	Binary Tree Traversals and Related Properties.

UNIT - IV	**8 Hours**

Space and Time Tradeoffs: Sorting by counting, Input Enhancement in String Matching, Hashing. **Dynamic Programming**: Three Basic Examples, the Knapsack Problem, Warshall's and Floyd's Algorithms.

Self-study component:	B-Trees, Optimal Binary Search Trees.

UNIT - V	8 Hours

Greedy Technique: Kruskal’s Algorithm, Prim’s Algorithm, Dijikstra’s Algorithm. Limitations of Algorithm Power: P, NP and NP- Complete Problems. Coping with the Limitations of Algorithm Power: Backtracking: n-Queens Problem, Subset-Sum Problem, Branch and Bound: Knapsack Problem.

Self-study component:	Lower Bound Arguments, Decision trees.

Course Outcomes: On completion of this course, students are able to:

Course Outcomes with ***Action verbs*** for the Course topics

CO1	.Understand the basic concepts of various algorithmic techniques
CO2	Analyze the asymptotic performance of algorithms
CO3	Design solutions for the given problem using algorithmic technique.

Text Book(s):

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, 2011. Pearson.

Reference Book(s):

1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

Web and Video link(s):

1. Algorithms: Design and Analysis, Part 1 (Coursera) | MOOC List (mooc-list.com)
2. https://onlinecourses.nptel.ac.in/noc15 _cs02/preview

CO-PO Mapping

CO	Statements	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	**Understand** the basic concepts of various algorithmic techniques	3												2		
CO2	**Analyze** the asymptotic performance of algorithms	1	2											2		
CO3	**Design** solutions for the given problem using algorithmic technique.	1	2	2										2		1

DATABASE MANAGEMENT SYSTEM (Integrated)
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code:	**P22CS404**	**Credits:**	**04**
Teaching Hours/Week (L: T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives:

1. To learn the basic knowledge of Database Management System and various types of data models.
2. To learn the concept and syntax of ER Diagram, relational data model and relational algebra.
3. To learn and write various SQL queries.
4. To learn the concept of Normalization.
5. To learn the various issues in Transaction processing.

UNIT – I	8 Hours

Introduction to Databases: Introduction, Characteristics of the database approach, Advantages of using the DBMS Approach.
Database System Concepts and Architecture: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence.
Introduction to ER model: Entity Types, Entity Sets, attributes and keys, Relation Types, Relationship Sets, roles, and structural constraints, Weak Entity Types, ER Diagrams.

Self-study component:	Actors on the scene, Workers behind the scene, Database Languages and Interfaces, Relationship Types of Degree Higher Than Two
Practical Topics: **(6 Hours)**	1. Introduction to ER diagram tool. (Draw.io) 2. Create an ER diagrams Company Database system and Banking database System using tool.

UNIT – II	8 Hours

Relational Model: Relational Model Concepts, Relational Model Constraints, update operations dealing with constraint violations, Relational Database Design using ER-to-Relational mapping.
Relational Algebra: Unary and Binary relational operations, Examples of simple queries in relational algebra.
Creation of table in SQL:SQL Data Definition and Data types.

Self-study component:	Additional relational operations,
Practical Topics: **(6 Hours)**	1. **Consider the company database and create the below tables by properly specifying the primary keys and the foreign keys** **Employee** (Fname: varchar, Minit: Char, Lname: varchar, ssn:int, Bdate: Date, Address: varchar, Sex: char, salary: decimal, Super_ssn:int, DNO:int) **Department** (Dname: varchar, Dnumber: int, mgr_ssn: int,

	mgr_start_date: date) **Dept_location** (Dnumber: int, Dlocation: varchar) **Project** (pname: varchar, pnumber: int, plocation: varchar, dnum:int) **Works_on** (Essn: int, pno:int, hours: decimal) **Dependent** (Essn: char, dependent_name: varchar, sex: char, Bdate: date, relationship: varchar) 2. Insert at least five tuples in each relation.	
UNIT – III		**8 Hours**
SQL: Specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, More Complex SQL Retrieval Queries.		
Self-study component:	Schema change statements in SQL.	
Practical Topics: **(4 Hours)**	1. Retrieve the name and address of all employees who work for the 'Research' department. 2. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date. 3. For each employee, retrieve the employee's first and last name and the first and last name of his or her immediate supervisor. 4. Make a list of all project numbers for projects that involve an employee whose last name is 'Smith', either as a worker or as a manager of the department that controls the project. 5. Retrieve all employees whose address is in Houston, Texas 6. Retrieve all employees in department 5 whose salary is between $30,000 and $40,000. Execute above quires for the Company database defined in Unit-II.	
UNIT – IV		**8 Hours**
Specifying Constraints as Assertions and Triggers**,** Views in SQL. **Basics of Functional Dependencies and Normalization for Relational Databases:** Informal design guidelines for relation schema, Functional Dependencies: Inference rules, Normal Forms based on Primary Keys:First ,Second and Third Normal Forms, Boyce–Codd Normal Form.		
Self-study component:	Nested Queries	
Practical Topics: **(4 Hours)**	1. Retrieve the names of all employees who do not have supervisors. 2. Retrieve the name of each employee who has a dependent with the same first name and is the same gender as the employee 3. Retrieve the names of employees who have no dependents. 4. List the names of managers who have at least one dependent. 5. Retrieve the Social Security numbers of all employees who work on project numbers 1, 2, or 3. 6. Find the sum of the salaries of all employees of the 'Research'	

	department, as well as the maximum salary, the minimum salary, and the average salary in this department. 7. For each department, retrieve the department number, the number of employees in the department, and their average salary. Execute above quires for the Company database defined in Unit-II.

UNIT – V	8 Hours

Database Design: Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Transaction Processing : Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on Serializability: Serial, Non-serial and conflict-serializable, Testing for conflict serializability of a schedule.

Self-study component:	Characterizing schedules based on recoverability
Practical Topics: **(4 Hours)**	Consider the following database for a **Banking enterprise:** **BRANCH** (branch-name: string,branch-city: string,assets: real) **ACCOUNT** (accno:int,branch-name: string,balance: real) **DEPOSITOR** (customer-name: string,accno:int) **CUSTOMER** (customer-name: string,customer-street: string,city: string) **LOAN** (loan-number:int,branch-name: string,loan-number-int) **BORROWER** (customer-name: string,customer-street: string,city: string) 1) Create the above tables by properly specifying the primary and foreign keys 2) Enter 5 tuples for each relation 3) Find all the customers who have atleast two accounts at the main branch 4) Find all the customers who have an account at all the branches located in a specified city 5) Demonstrate how you delete all account tuples at every branch located in a specified city

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics.
CO1	**Apply** the database concepts to create the relations by specifying various constraints.
CO2	**Desi**gn ER diagrams for given scenario.
CO3	**Apply** suitable normalization technique to improve database design.
CO4	Conduct experiments on given database using modern tools: Draw io,MySQL.

Text Book(s):

1. Fundamentals of Database Systems – Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011.

Reference Book(s):

1. Data Base System Concepts – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-Graw Hill, 2006
2. An Introduction to Database Systems – C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_cs91/
2. https://youtu.be/c5HAwKX-suM

NPTEL Web Course:

1. https://onlinecourses.nptel.ac.in/noc18_cs15/preview
2. http://nptel.ac.in/courses/106106093/
3. http://nptel.ac.in/courses/106106095/

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Apply** the database concepts to create the relations by specifying various constraints.	3												3	3	
CO2	**Design** ER diagrams for given scenario.	2	2	3									1	3	3	
CO3	**Apply** suitable normalization technique to improve database design.	3	1	2										2	2	
CO4	Conduct experiments on given database using modern tools: Draw io,MySQL.	2	2	2	1	3				1			1	3	3	

AVR MICROCONTROLLER (Integrated)
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code:	**P22CS405**	**Credits:**	**04**
Teaching Hours/Week (L: T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives:

- Explain the fundamentals of AVR microcontroller
- Develop ALP/C programs using arithmetic and logical instructions
- Implement ALP/C code to accept data from external device process it and send the data to external device.
- Implement the code for an application which require modular programming concept.

UNIT – I	**8 Hours**

Microcontrollers And Embedded Processors: Microcontroller versus microprocessors, Criteria for choosing microcontroller. Overview of the AVR family, General purpose registers in AVR, the AVR data memory, AVR status register, AVR assembler directives-.EQU, .ORG, .SET and .INCLUDE. The program counter and program ROM space in AVR- Program counter in the AVR, ROM memory map in the AVR family, ROM width in the AVR.

Self-study component:	Numbering and coding system, Semiconductor Memories, Harvard and Von Neumann Architecture.
Practical Topics: **(6 Hours)**	Use ATMEL studio software and observe the contents of various registers, ports and memory with simple alp programs.

UNIT – II	**8 Hours**

Data transfer instructions-LDS,LDI, MOV, STS. **Arithmetic instructions** (unsigned numbers)- ADD, ADC, ADDI, ADDIW, SUB, SBC, SUBI, SBCI, SBIW, MUL, Division, INC, DEC, CP. **Logical instructions**- AND, OR EOR, COM, NEG, ROL, ROR, LSR, LSL, ASR and SWAP. **Branch instructions and looping**- BREQ, BRNE, BRSH, BRLT, BRGE, BRVS, BRVC, BRCC and BRCS.

Self-study component:	Arithmetic instructions (signed numbers). Unconditional branch instructions.
Practical Topics: **(6 Hours)**	1. Write a program to find greatest of three numbers. 2. Write a program to div two numbers. 3. Write a program to whether the given number is power of 2 or not.

UNIT – III	**8 Hours**

Call instructions and Stack: CALL, RCALL, and ICALL. I/Oport programming in AVR, I/O Bit-manipulation programming.

Self-study component:	AVR time delay: time delay calculation for AVR

Practical Topics: **(4 Hours)**	1. Write a program to find the factorial of given positive number. 2. Write a program to accept two 8 bit numbers from PORTA and POTRB. Multiply two numbers and send the result to PORTC (lower byte) and PORTD (higher byte). 3. Write a program to monitor the bit 1 of PORTC. If set send 'Y' to PORTA else send 'N' to PORTB.
UNIT – IV	**8 Hours**
BCD and ASCII conversion, Addressing Modes- single register, two register, Direct addressing mode, indirect addressing mode. Macros.	
Self-study component:	Timer0 programming and look up table and table processing.
Practical Topics: **(4 Hours)**	1. Write a program to convert packed BCD to ASCII. 2. Write a program to add 5 bytes of data stored starting from $300. Store the sum in R21 and carry in R22. (Use direct addressing mode). 3. Write a program to count number of odd and even numbers among n bytes of data stored starting from $600 (Use indirect addressing mode).
UNIT – V	**8 Hours**
AVR programming in C: Data types and time delays in C, I/O programming in C, Logic operations in C, Data conversion programs in C, Memory allocations in C. Data serialization in C.	
Self-study component:	Keypad interfacing: Interfacing the keypad to AVR
Practical Topics: **(4 Hours)**	Simulate the following programs using simulator 1. Write a program to blink LED with appropriate delay. 2. Connect a push button and LED to the controller. Read the status of button and show the status of button on LED. 3. Write a program to display the given massage LCD.

Course Outcomes: O On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics.
CO1	**Explain** the basic architecture and AVR instructions.
CO2	**Apply** AVR assembly instructions to process the data stored in memory/register/io.
CO3	**Apply** AVR C instructions to process the data.
CO4	**Analyze** the given assembly program to identify bugs and write correct code and output.
CO5	**Conduct** experiments using IDE and simulator to demonstrate the features of AVR micro controller.

Text Book(s):

4. The AVR microcontroller and embedded system using assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi.

Reference Book(s):

1. Programming and interfacing ATMEL's AVRs by Thomas grace.

Web and Video link(s):

2. https://www.youtube.com/watch?v=LquFL2dlvDE
3. https://slideplayer.com/slide/3221593/
4. https://www.youtube.com/watch?v=AjLUU3cDx08

E-Books/Resources:

1 https://electrovolt.ir/wpcontent/uploads/2017/02/AVR_Microcontroller_and_Embedded_Electrovolt.ir_.pdf

2 https://researchdesignlab.com/projects/AVR%20BOOK.pdf

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**Explain** the basic architecture and AVR instructions.	2														
CO2	**Apply** AVR assembly instructions to process the data stored in memory/register/IO.	2	2	2										1		
CO3	**Apply** AVR C instructions to process the data.	2	2	2										1		
CO4	**Analyze** the given assembly program to identify bugs and write correct code and output.	2	2	2										1		
CO5	**Conduct** experiments using IDE and simulator to demonstrate the features of AVR micro controller.	2	2	2		2				1			1	1		

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code:	**P22CSL406**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Lab Hours:	**24**	**SEE Marks:**	**50**

Note: Implement the following programs using *C* Language

Experiments

1.	Print all the nodes reachable from a given starting node in a digraph using BFS method.
2.	Obtain the Topological ordering of vertices in a given digraph (DFS Based).
3.	Sort a given set of elements using Merge sort method and determine the time taken to sort the elements. Repeat the experiment for different values of *n*, the number of elements in the list to be sorted and plot a graph of the time taken versus *n*.
4.	Sort a given set of elements using Quick sort method and determine the time taken to sort the elements. Repeat the experiment for different values of *n*, the number of elements in the list to be sorted and plot a graph of the time taken versus *n*.
5.	Find the Pattern string in a given Text string using Horspool's String Matching Algorithm.
6.	Sort a given set of elements using Heap Sort algorithm.
7.	Implement 0/1 Knapsack problem using Dynamic Programming.
8.	From a given vertex in a weighted connected graph, find shortest paths to other Vertices using Dijikstra's algorithm.
9.	Find minimum cost spanning tree of a given undirected graph using Kruskal's Algorithm.
10.	Implement Sum-of-Subset problem of a given set S = {s1, s2, ..., sn} of 'n' positive ntegers whose sum is equal to a given positive integer'd'.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Implement the algorithms based on various algorithm design techniques.
CO2	Analyze the efficiency of various algorithms.

CO-PO Mapping

CO	**Statements**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**Implement** the algorithms based on various algorithm design techniques.	2	2	2		2							1	2		
CO2	**Analyze** the efficiency of various algorithms.	2	2											2		

EMPLOYABILITY ENHANCEMENT SKILLS - IV

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV for CSE, ISE, ECE, CSE(AIML), CSBS & CSE(DS) Branches only

Course Code:	**P22HSMC407B**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving simple and compound interest, averages, alligations & mixtures, proportions, variations and partnership.
- Explain concepts behind logical reasoning modules of series, coding & decoding, seating and data arrangements.
- Develop problem solving skills through Data structures.

UNIT – I		**06 Hours**

Quantitative Aptitude: Simple and Compound Interest, Averages.

Logical Reasoning: Series, Coding & Decoding.

Self-study component:	Mensuration

UNIT – II		**06 Hours**

Quantitative Aptitude: Alligations and Mixtures, Ratios, Proportions and Variations.

Logical Reasoning: Seating Arrangement, Data Arrangement.

Self-study component:	Types of cryptarithm

UNIT – III		**06 Hours**

Quantitative Aptitude: Partnership.

Verbal Ability: Sentence Completion, Ordering of Sentences.

Self-study component:	Game based assessments

UNIT – IV	**DATA STRUCTURES I - Problem Solving Techniques and Object-Oriented Programming**	**06 Hours**

Recursion: Introduction to recursion, Principle of mathematical induction, Fibonacci numbers, Recursion using arrays, Recursion using strings, Recursion using 2D arrays.

Time and Space Complexity: Order complexity analysis, Theoretical complexity analysis, Time complexity analysis of searching and recursive algorithms, Theoretical space complexity, Space complexity analysis of merge sort.

Backtracking: Introduction to Backtracking, Rat In a Maze, N-queen, Word Search.

Basics of OOP: Introduction to oops, Creating objects, Getters, and setters, Constructors and related concepts, Inbuilt constructor and destructor, Example classes.

Advance Concepts of OOP: Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism, Virtual functions, Abstract classes, Exception handling.

Self-study component:	Examples of Abstract Data Type

UNIT – V	DATA STRUCTURES II – Linear Data Structures and Tress	06 Hours

Linked Lists: Introduction to linked list, Inserting node in linked list, Deleting node from linked list, Midpoint of linked list, Merge two sorted linked lists, merge sort of a linked list, Reversing a linked list.

Stacks and Queues: Introduction to stacks, Stack using arrays, Dynamic Stack class, Stack using linked list, Inbuilt stack, Queue using arrays, Dynamic queue class, Queue using linked list, Inbuilt queue.

Generic Trees: Introduction to Trees, Making a tree node class, Taking a tree as input and printing, Tree traversals, Destructor for tree node class.

Binary Trees: Introduction to Binary Trees, Taking a binary tree as input and printing, Binary Tree traversals, Diameter of binary tree.

Binary Search Trees: Introduction to Binary Search Trees, Searching a node in BST, BST class, Inserting and Deleting nodes in BST, Types of balanced BSTs.

Self-study component:	Huffman tree, Expression Trees.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Solve the problems based on simple and compound interests, averages, alligations & mixtures, ratios, proportions, variations and partnerships.	Applying	L3
CO2	Solve logical reasoning problems based on seating arrangements, data arrangement and verbal ability skills of sentence corrections and ordering of sentences.	Applying	L3
CO3	Analyze and represent various data structures and its operations.	Analyzing	L4
CO4	Develop programs with suitable data structure based on the requirements of the real-time applications	Applying	L3

Text Book(s):

1. Data Structures and Algorithms Made Easy by Narasimha Karumanchi
2. Data Structures through C in Depth by by S K Srivastava and Deepali Srivastava
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, “Data Structures using C”, 2014, low price edition ,Pearson education.
2. Seymour Lipschutz ,”Data Structures with C (Schaum's Outline Series)” , July 2017, McGraw Hill Education.
3. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Data Structures and algorithms offered by NPTEL: https://nptel.ac.in/courses/106102064/

COURSE ARTICULATION MATRIX
(EMPLOYABILITY ENHANCEMENT SKILLS - IV – P22HSMC407)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										
CO4	1	1	2									1

Internship - I [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P22INT409**	**Credits:**	**02**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**-**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**100**

All the students registered to II year of BE shall have to undergo a mandatory internship of 02 weeks during the intervening vacation of II and III semesters or III and IV semester. Internship shall include Inter / Intra Institutional activities. A Semester End Examination (Presentation followed by question-answer session) shall be conducted during IV semester and the prescribed credit shall be included in IV semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent Semester End Examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

PHYSICAL EDUCATION
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER - IV

Course Code:	**P22PED409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Fitness Components	**Track Events**
Athletics Track- Sprints Jumps- Long Jump Throws- Shot Put	1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. 1.2. Acceleration with proper running techniques. 1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. **Long Jump**: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing **Shot put**: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique.
Kho kho	A. **Fundamental skills** 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations B. **Rules and their interpretation and duties of officials**.
Throw ball Athletics Track- 110 &400 Mtrs Hurdles Jumps- High Jump Throws- Discuss Throw	A. **Fundamental skills:** Overhand service, Side arm service, two hand catching, one hand overhead return,side arm return. B. **Rules and their interpretations and duties of officials** **110 Mtrs and 400Mtrs**: Hurdling Technique :Lead leg Technique, Trail leg Technique ,Side Hurdling, Over the Hurdles Crouch start (its variations) use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. **High jump**: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. **Discus Throw**: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).

YOGA

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - IV

Course Code:	**P22YOG409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Course objectives:

6) To enable the student to have good health.
7) To practice mental hygiene.
8) To possess emotional stability.
9) To integrate moral values.
10) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical

10. Improved body flexibility and balance
11. Improved cardiovascular endurance (stronger heart)
12. Improved digestion
13. Improved abdominal strength
14. Enhanced overall muscular strength
15. Relaxation of muscular strains
16. Weight control
17. Increased energy levels
18. Enhanced immune system

- Mental

4. Relief of stress resulting from the control of emotions

5. Prevention and relief from stress-related disorders
6. Intellectual enhancement, leading to improved decision-making skills

- Spiritual

4. Life with meaning, purpose, and direction
5. Inner peace and tranquility
6. Contentment

Patanjali's Ashtanga Yoga, its need and importance.
Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan
Suryanamaskar12 count- 4 rounds of practice
Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas
a. Sitting 1. Sukhasana
2. Paschimottanasana
b. Standing 1. Ardhakati Chakrasana
2. Parshva Chakrasana
c. Prone line 1. Dhanurasana
d. Supine line 1. Halasana
2. Karna Peedasana
Meaning, importance and benefits of Kapalabhati.
40 strokes/min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana
4. Chandra Bhedana 5. Nadishodhana

Additional Mathematics - II [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV (Lateral Entry: Common to all branches)**			
Course Code:	**P22MDIP401**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**
Course Objectives: The mandatory learning course**:** **P21MATDIP401** viz., **Additional Mathematics-II** aims to provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/ methods to solve them, Laplace & inverse Laplace transforms and elementary probability theory.			
UNIT-I			
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix. **Self-study Components**: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.			**10 Hrs**
UNIT-II			
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation. **Self-study Components**: Method of undetermined coefficients			**12 Hrs**
UNIT-III			
Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration. Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems. **Self-study Components**: Orthogonal curvilinear coordinates.			**10 Hrs**
UNIT-IV			
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. **Self-study Components**: Application to solutions of linear differential equations and simultaneous differential equations..			**12Hrs**
UNIT-V			
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. **Self-study Components**: State and prove Bayes's theorem			**06Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2:	Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
CO3:	Identify - the technique of integration evaluate double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4:	Explore the basic concepts of elementary probability theory and, apply the same to the problems of decision theory,

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

Additional Communicative English - II

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code:	P22HDIP407	**Credits:**	00
Teaching Hours/Week (L:T:P):	0:2:0	**CIE Marks:**	100
Total Number of Teaching Hours:	30	**SEE Marks:**	-

Module-1

Listening Skills II **2 Hours**

Levels of listening, Active listening, Techniques of listening. Activity: Listening for main ideas and Listening for specific information

Speaking Skills II **6 Hours**

Language of discussion – Giving opinion, agreeing / disagreeing, asking questions, making suggestions. Sentence stress – content and structure words, Speaking situations, Intonations and Summarizing skills

Module-2

Reading Skills II **2 Hours**

Guessing meaning from the context, Understanding graphical information, Summarizing. Activity: Book review

Writing Skills II **4 Hours**

Linkers and connectives, Sentence and paragraph transformation, Mind mapping techniques, Letter writing, Essay writing

Module-3

Email Etiquette **4 Hours**

Parts of an email, Writing an effective subject line, email language and tone. Activity: Email writing practice - Scenario based emails

Group Presentations **2 Hours**

Group presentations by the students

Module-4

Goal Setting **2 Hours**

Defining goals, types of goals, Establishing SMART goals, Steps in setting goals, Goal setting activity

Individual Presentations **4 Hours**

Individual presentation by the students

Module-5

Teamwork **4 Hours**

Defining teams, Team vs. Group, Benefits and challenges of working in teams, Stages of team building, Building effective teams, Case studies on teamwork

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

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018
6. The 7 habits of highly effective people by Stephen R Covey, Simon & Schuster – 2020
7. You Are the Team: 6 Simple Ways Teammates Can Go from Good to Great by Michael G. Rogers

CO – PO – PSO Matrix

CO	**PO**												**PSO**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1												2			
CO 2										2					
CO 3										2					
CO 4									2						
CO									**2**	**2**		**2**			