Syllabus of BCA

101-Artificial Intelligence and Machine Learning / 102-Data Science

INDUCTION PROGRAM: One Week (30 Hrs)

duction program (mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	- Physical activity - Creative Arts - Universal Human Values - Literary - Proficiency Modules - Lectures by Eminent People - Visits to local Areas - Familiarization to Department/Branch & Innovations

Mandatory Visits/Workshop/Expert Lectures:

1. It is mandatory to arrange one industrial visit every semester for the students of each branch.

2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/industry/entrepreneurial orientation.

3. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

Semester-I

101CC101/ 102CC101	Mathematics Foundation to Computer Science	3L:0T:0P	3 Credits

Course Objectives

CO1: Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.

CO2: This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.

CO3: This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.

Course Content:

UNIT-I:	**Set, Relation, Counting and Recurrence Relation:**
	Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set Closures of Relations.
	Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem. Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method. **(12 Hrs.)**
UNIT-II:	**Elementary Graph Theory And Matrix Algebra:** Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix. **(11 Hrs.)**
UNIT-III	**Logic and Methods of Proofs:** Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF). Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction. **(11 Hrs.)**
UNIT-IV	**Numerical Methods:** Concept and importance of errors in numerical methods. Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods. Numerical Interpolation: Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula. Numerical Integration : Trapezoidal rule and Simpson's1/3rule **(11 Hrs.)**

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A.K., Matrices, Krishna Prakashan, 2022.
6. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
7. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL,2022.
8. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
9. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Grimaldi Ralph P. and Ramana B. V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education,2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Web-Resources

1. https://nptel.ac.in/courses/106103205
2. https://nptel.ac.in/courses/111101115
3. https://nptel.ac.in/courses/111107127
4. https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf

101SEC101/ 102SEC101	**Problem Solving Using C**	**3L:0T:0P**	**3 Credits**

Course Objectives

CO1 : Understand basic terminology of computers, problem solving, programming Languages and their evolution (Understand)

CO2   : Design the solution from specification of a problem and write pseudo code of the algorithm using basic building block so structured programming constructs(Sequence, Selection and Repetition statement). (Create)

CO3 : Translate an algorithm in to a C computer program (Create)

CO4 : Testing and analyzing programs using debugging tools. (Analyze)

Course Content:

UNIT-I	Algorithm, flowcharting, Types of programming languages. History of C language, Advantages, Structure of C program, Character set, Identifiers, Keywords, Constants and Variables, Symbolic constants, Qualifiers, Type conversion. Operators , Operator Precedence and Expressions **(12 Hrs.)**
UNIT-II	Formatted I/O : scanf(), printf(), Unformatted I/O : getch(), getchar(), gets(), putch(), putchar(), puts(). Control structures: Branching: if, if-else, Conditional operator(? :), nested if, else-if Ladder. Looping: while, do-while, for statements, comma operator, nested loops, goto, break, continue. **(11 Hrs.)**
UNIT-III	Arrays - Declaration and initialization of one and two dimensional array Functions - Definition of function, Types of Functions, function prototype, categories of function, actual argument, formal argument, function calling: call by value, call by reference, function parameters, local and global variable, functions with array, function recursion. String functions - String functions :strlen(), strcpy(), strcmp() &strcat(), Recursion and Application of it. **(11 Hrs.)**
UNIT-IV	Structure - Definition, declaration, initialization, array of structure, nested structure, union. Pointers - Declaration, initialization, pointers arithmetic **(11 Hrs.)**

Text Books
1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. Brian W. Kernighan, Dennis M. Ritchie, C Programming Language, 2nd Edition Prentice Hall; 2 edition (April 1, 1988)
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition, Pearson,2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Designin C, 8th edition, Pearson, 2015.

101LabSEC101/ 102LabSEC101	Problem Solving Using C	0L:0T:4P	2 Credits

Suggestive Laboratory Experiments

1. Converting degrees Celsius to Fahrenheit and vice versa?
2. Display three input numbers in sorted (non-decreasing) order?
3. Given a positive integer value $n (>=0)$ display number, square and cube of numbers from 1 to n in a tabular format?
4. Given an input positive integer number, display odd numbers from in the range[1,n]?
5. Display first mathematical tables, each table upto10 rows? Generalize this to display first n (>0) mathematical tables up to m (m >0)rows?
6. Display following patterns of n rows (n>0), For the below examples n=5? For each pattern write a separate algorithm/program?
7.

$	$	12345	12345
$$	$$	1234	1234
$$$	$$$	123	123
$$$$	$$$$	12	12
$$$$$	$$$$$	1	1

8 Display the following patterns of n rows (n>0), for the below examples n=5?

Hollow square pattern:	Triangle Patterns with numbers:	Square with diagonals:	Diamond Pattern
##### # # # # # # #####	1 121 12321 1234321 123454321	* * * * * * * * * * * * * * * * * * * * *	* *** ***** *** *

8. Display the first n (n>0) terms of the Fibonacci sequence?
9. Display the Factorial of number?
10.   Design Program for Sum of Array elements .
11.   Compute character grade from the marks ($0 \le$ marks ≤ 100) of a subject. Grading Scheme: 80-100 : A, 60 - 79: B, 50 - 59: C, 40-49: D, 0-39: F? Solve this using both else-if ladder and switch-case?*******

12.   Compute body mass   index,   BMI = weight in KGs / (Height in Meters * Height in Meters),

Both weight and height values are positive real numbers. Your program should display BMI value followed by whether the person is Underweight, Normal, Overweight or Obese using the below ranges:BMI Values Underweight: less than 18.5, Normal:>=18.5 and < 25

            Overweight: >= 25 and < 30

            Obese: >= 30

13. Design a modularized algorithm / program to compute a maximum of 4 numbers?

14. Design algorithm / program to perform matrix operations addition, subtraction and transpose?

15. Recursive solutions for the problems: Factorial of a number.

16. Design program for union .

17. Design Program for Student using structure

18. Design Programs to show use of Pointer and its Arithmetic Operations

19. Design Programs for different User defined functions

20. Design Programs for different library string functions and math functions.

101CC102/ 102CC102	Computer Architecture	3L:0T:0P	3 Credits

Course Objectives

CO1: To Understand the basics of Digital Electronics and Binary Number System
CO2: To Learn the implementation of Combinational Circuit.
CO3: To Learn the implementation of Sequential Circuit.
CO4: To Understand the Organization of basic computers.

Course Content:

UNIT-I	**Number Systems:** Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess-3 Code, The Gray Code. **Digital Principles:** Logic Gates (AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR **(12 Hrs.)**
UNIT-II	**Combinational Circuits:** Half and full Adder Subtractor, Decoders, Multiplexer, Demultiplexer **Sequential Circuits:** Flip-Flops- CLK SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop. **Register:** 4 bit shift register (SISO) **Binary Counter**- 4-bit synchronous and Asynchronous binary counter. **(11 Hrs.)**
UNIT-III	**Computer Basics:** Definition of Computer, Applications, Characteristics of Computer, block diagram of computer. **Memory:** Primary Memory: RAM , ROM , PROM , EPROM, EEPROM and Cache memory **Input Devices:** Keyboard, Mouse, Joystick, Scanner, Mic, Display Devices (LED & Touch Screen). **Output Devices:** Speaker, Plotter, Printer, Types of Printer. **Secondary storage:** Hard disk, SSD, PD **(11 Hrs.)**
UNIT-IV	**Basic Computer Organization and Design:** Design of Basic Computer, Central Processing Unit: Computer Registers, General Register Organization, Stack Organization, Instruction Codes, Computer Instructions, Instruction Formats, Addressing Modes. **(11 Hrs.)**

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha-"Digital Principles & Applications", Tata McGrawHill Education Private Limited, 2011 Edition.
2. M. Morris Mano - "Computer System Architecture ", Pearson / Phi, Third Edition.

Reference Books:

1 William Stallings - " Computer Organization and Architecture " , Pearson / PHI, Sixth Edition,
2 Andrew S. Tanenbaum - "Structured Computer Organization", PHI / Pearson 4th Edition,
3 M.V. Subramanyam,"Switching Theory and Logic Design", Laxmi Publications(P)Ltd.

4   Ikvinder pal Singh, Computer Organization Architecture, Khanna Book Publishing.

101LabCC102/ 102LabCC102	Computer Architecture	0L:0T:4P	2 Credits

Suggestive Laboratory Experiments:
1. Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. Design and test of an S-R flip-flop using NAND / NOR gate.
4. Verification of Truth Tables of J-K Flip-Flop using NAND / NOR gate
5. Realize Decoder and Encoder circuit using Basic Gates.
6. Design and implement the 4 :1 MUX using gates.
7. Design and verify operation of half adder and full adder.
8. Design and verify operation of half subtractor.
9. Design and implement a 4 bit shift register using Flip flops.
10.   Design and implement a 4 bit synchronous counter.

Hardware

1. Familiarize the computer system layout : marking positions of SMPS, mother board, FDD, HDD, CD, DVD and add on cards.
2. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
3. Identify and Troubleshoot the problems of RAM, SMPS and mother-board
4. Configure BIOS settings-disable and enable US Band LAN
5. Adding additional RAM to the system. (expanding RAM size).
6. To Study mother board layout of a system.
7. Demonstrate the assembly of a PC
8. Demonstration of various ports : CPU, VGA port, PS / 2 (keyboard, mouse), USB, LAN, Speaker, Audio.
9. Install and configure windows OS
10.To study the installation of Printer and troubleshooting.

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101AEC101/ 102AEC101	General English - I	1L:1T:0P	2 Credits

Course Objective:

CO1: To provide learning environment to practice listening, speaking, reading and writing skills.

CO2: To assist the students to carry on the tasks and activities through guided instructions and materials.

CO3: To effectively integrate English language learning with employability skills and training.

CO4: To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

Course Content:

UNIT-I	**Vocabulary Building** The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations. **(4 Hrs.)**
UNIT-II	**Basic Writing Skills** Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely **(4 Hrs.)**
UNIT-III	**Identifying Common Errors in Writing** Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies **Nature and Style of sensible Writing** Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V : Writing Practices, Comprehension, Précis Writing, Essay Writing**. (4 Hrs.)**
UNIT-IV	**Oral Communication (This Module involves interactive practice sessions in Language Lab)** Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations. **(3 Hrs.)**

Text / Reference Books:
1. AICTE's Prescribed Text book: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. KulBhushan Kumar, Khanna Book Publishing,2022.
3. Practical English Usage. MichaelSwan.OUP.1995.
4. Remedial English Grammar. F.T.Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book.2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press.2006.
7. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Alternative NPTEL / SWAYAM Course:

S.No.	NPTEL/SWAYAM Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha Iqbal	IITMADRAS
2	Technical English forengineers	Prof. Aysha Iqbal	IITM

Course Outcomes: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

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101MDE101/ 102MDE101	Indian Knowledge System	2L:0T:0P	2 Credits

IKS : Indian Knowledge Systems and Traditions

Course Objectives

- To sensitize the students about context in which they are embedded i.e. Indian culture and civilization including its Knowledge System and Tradition.
- To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
- To help to study the enriched scientific Indian heritage.
- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology

Detailed contents:

Module1: Introduction to IKS

(Any eight of total sessions assigned for Literary activity)
Introductory lecture on the **any eight** topics below:

1. Indian Knowledge System
2. Indian Culture & Civilization
3. Ancient Indian Chemistry
4. Ancient Indian Metallurgy
5. Ancient Indian Mathematics
6. Ancient Indian Astronomy
7. Indian Astronomical Instruments
8. Indian Knowledge System (Upveda : Ayurveda)
9. Indian Knowledge System (Upveda : Gandharveda)
10. Indian Knowledge System(Vedangas: Shiksha, Kalpa, Vyakrana)
11. Indian Knowledge System (Vedangas : Jyotisha, Nirukta, Chandas)
12. Indian Architecture I : Sthapatya -Veda
13. Indian Architecture II : Temples
14. Indian Architecture III : Town & Planning
15. Indian Philosophical System.   **(15 Hrs.)**

Module 2 : Introduction to Creative Practices

(Twenty Lectures with at least Five different topics of total session under Creative activity)

Introductory lecture on the topics below:

1. Dhatuvada : art of metallurgy
2. Akarajnana : art of mineralogy

3. Vastuvidya : art of engineering
4. Yantramatrika: art of mechanics
5. Takshana : art of carpentry
6. Chalitakayoga : art of practicing as a builder of shrines
7. Raupyaratna pariksha : art of testing silver and jewels
8. Maniragajnana : art of tinging jewels

9. Sucivayakarma : art of needle works and weaving
10. Vadya vidya : art of playing on musical instruments
11. Geet vidya: art of singing
12. Nritya vidya : art of dancing
13. Natya vidya : art of the atricals
14. Alekhya vidya : art of painting
15. Viseshakacchedya vidya: art of painting the face and body with color
16. Udakavadya : art of playing on musicin water
17. Manasika vyakriya : art of composing verse
18. Bhushanayojana : art of applying or setting ornaments
19. Citrasakapupa bhakshya vikara kriya : art of preparing varieties of delicious food
20. Dasanavasanangaraga : art of applying preparations for cleansing the teeth, cloths and painting the body
21. Utsadana : art of healing or cleaning a person with perfumes
22. Vastragopana : art of concealment of cloths
23. Balakakridanaka : art of using children's toys
24. Tandulakusumabali vikara : art of preparing offerings from rice and flowers
25. Pushpastarana : art of making a covering of flowers for a bed.   **(15 Hrs.)**

References:
1. Text book on IKS by Prof. B Mahadevan, IIM Bengaluru
2. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay,1995.
3. The Cultural Heritage of India. Vol. I. Kolkata: Ramakrishna Mission Publication,1972.
4. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
5. Dr. R. C. Majumdar, H. C. Ray Chaudhuri and Kalikinkar Datta : An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
6. Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore : University of Mysore.
7. Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinentfromc. *7000* B C Eto C E 1200. London : Routledge.

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101VAC101/ 102VAC101	Environmental Science and Sustainability	2L:0T:0P	2 Credits

Course description:
This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forth coming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. The course content is divided into four comprehensive units.

Course Objective(s):
CO1 This course aims to familiarize students with basic environmental concepts, their relevance to business operations, and forth coming sustainability challenges.
CO2 This course will equip students to make decisions that consider environmental consequences.
CO3 This course will enable future business graduates to become environmentally sensitive and responsible managers.

Course Content:

UNIT-I	**Understanding Environment, Natural Resources, and Sustainability**
	Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, them an-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education. **(7 Hrs.)**
UNIT-II	**Ecosystems, Biodiversity, and Sustainable Practices**
	Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation. **(8 Hrs.)**
UNIT-III	**Environmental Pollution, Waste Management, and Sustainable Development** Varioustypesofenvironmentalpollution,includingair,water,noise,soil, andmarinepollution,andtheirimpactsonbusinessesandcommunities.Causesofpolluti on,suchasglobalclimatechange,ozonelayerdepletion,thegreenhouseeffect,andacidra in,withaparticularfocusonpollutionepisodesinIndia.Importanceofadoptingcleanerte chnologies;Solidwastemanagement; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts. **(7 Hrs.)**
UNIT-	**Social Issues, Legislation, and Practical Applications**

IV	Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India. **(8 Hrs.)**

Text Books(Latest Editions):
- Poonia, M. P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
- Bharucha, E. Textbook of Environmental Studies (3rded.) Orient Black swan Private Ltd.
- Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
- Rajagopalan, R. Environmental studies : from crisis ocure (4thed.). Oxford University Press.
- Miller, G. T. & Spool man S. Living in the Environment. (20thed.). Cengage.
- Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
- Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
- Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
- Wright, R. T. & Boorse, D. F. Environmental Science: Toward A Sustainable Future(13thed,). Pearson.

Web:
1. https://www.ourplanet.com
2. https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
3. www.myfootprint.org
4. https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/eco system
5. /ecosystem.html

Course Outcome(s):

6. Explore the basic environmental concepts and issues relevant to the business and management field.
7. Recognize the interdependence between environmental processes and socio-economic dynamics.
8. Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
9. Identify possible solutions to curb environmental problems caused by managerial actions.
10. Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

SEMESTER-II

101CC103/ 102CC103	Object Oriented Programming using C++	3L:0T:0P	3 Credits

Course Objectives:
CO1. To provide students with understanding of code organization and functional hierarchical decomposition with using data types.
CO2. Programming is about writing the instructions which a computer follows to enable it to store knowledge, process knowledge, and communicate knowledge with the outside world.

Course Content:

UNIT-I	**C++ Basics** History of C++ , Features of C++, Tokens, Keywords, Identifiers, Variables, Scope of variables, Constants, Basic Data types, User defined, derived data types, type conversion, Basic Operators, Scope resolution operators, type casting , Structure of C++ program, Control Structures, I/O Statements, **(12 Hrs.)**
UNIT-II	**Classes and Objects**: Classes and Objects Introduction, Defining a Class, array within class, array of objects **Functions:** Function Prototyping, call by reference, return by reference, Inline Function, Default Argument, Function Overloading, friend and virtual function **Constructor & Destructor:** Introduction, Parameterized Constructor, Multiple constructors in class, constructors with default arguments, Copy constructors, Destructors. **(11 Hrs.)**
UNIT-III	**Inheritance:** Definition, Types of Inheritance: Single, Multiple, Hierarchical, Multilevel, Hybrid, Visibility Modes **Pointers & Polymorphism:** pointers, pointers to object, this pointer, pointers to derived classes, virtual functions. **Operator Overloading:** Operator function, Unary and Binary operator overloading **(11 Hrs.)**
UNIT-IV	**Exception handling:** Introduction, basics, throwing mechanism, catching mechanism. **Working with Files:** Introduction, classes for file stream operations, Opening and closing files, File modes, File pointers and their manipulations, sequential I/O operations, Updating a File: Random Access, Error handling during File handling. **(11 Hrs.)**

Text books:
1. Object oriented programming with C++: E.Balagurusamy
2. Learn To Program With C++ , by John Smiley , 1st Edition
3. The C++ Programming Language, by Bjarne Stroustrup, 4th Edition

Reference Books:
1. The Object-Oriented Thought Process, 5th Edition by Matt Weisfeld
2. An Introduction to Object-Oriented Programming: Timothy Budd
3. The C++ programming language: Bjarne Stroustrup
4. Programming principles and Practice using C++: Bjarne Stroustrup

Weblink to Equivalent MOOC on SWAYAM if relevant:
- https://onlinecourses.nptel.ac.in/noc20_cs59/preview
- https://onlinecourses.nptel.ac.in/noc19_cs48/preview
- https://www.classcentral.com/course/swayam-programming-in-c-6704
- https://www.naukri.com/learning/articles/oops-concepts-in-c-plus-plus/

Weblink to Equivalent Virtual Lab if relevant:
1. http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/exp1/index.php

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101CC104/ 102CC104	Data Structures	3L:0T:0P	3 Credits

Course Objectives

CO1: Understand the fundamental concepts of Data Structures and their applications.

CO2: Develop problem-solving skills using Data Structures.

CO3: Implement Data Structures using C programming language.

Prerequisite:

1. **Programming Fundamentals:** Understanding the basic syntax and semantics of C programming language.
2. **Problem-Solving Skills :** Ability to break down a problem into smaller steps and devise a step-by-step solution and familiarity with simple algorithms.

Course Content:

UNIT-I	**Introduction and Overview:** Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Trade off. **Arrays:** Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching : Linear Search and Binary Search, Comparison of Methods. Sorting : Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two-Dimensional Arrays in Memory, Matrices and S parse Matrices, Multi-Dimensional Arrays. **(12 Hrs.)**
UNIT-II	**Linked Lists:** Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials. **Hashing and Collision:** Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining. **(11 Hrs.)**
UNIT-III	**Stacks:** Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression. **Recursion:** Definition, Recursive Notation, Runtime Stack, Applications of Recursion Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi. **Queues:** Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues. **(11 Hrs.)**
UNIT-IV	**Graphs:** Definition, Terminology, Representation, Traversal.

	Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees. **(11 Hrs.)**

Text Books

1. R.B. Patel, "Expert Data Structures with C", Khanna Book Publishing Company, 2023(AICTE Recommended Textbook)
2. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill,2011.
3. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications,2022.

Reference Books

1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press,2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

Web Resources

1. Geeks for Geeks-Data Structures Tutorial
2. Khan Academy-Algorithms Course

101LabCC104/ 102LabCC104	Data Structures	0L:0T:4P	2 Credits

Lab Programs:
1. Write a program for insertion and deletion operations in an array.
2. Write a program to search for an element in an array using Linear Search and Binary Search.
3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.
4. Write a program to merge two arrays.
5. Write a program to add and subtract two matrices.
6. Write a program to multiply two matrices.
7. Write a program to insert an element in to a Singly Linked List:
    (a) At the beginning
    (b) At the end
    (c) At a specified position
8. Write a program to delete an element from a Singly Linked List:
    (a) At the beginning
    (b) At the end
    (c) A specified element
9. Write a program to implement stack operations using an array.
10. Write a program to implement stack operations using a linked list.
11. Write a program to add two polynomials using a linked lists.
12. Write a program to evaluate a postfix expression using a stack.
13. Write a program to perform the following using recursion:
    (a) Find the factorial of a number
    (b) Find the GCD of two numbers
    (c) Solve Towers of Hanoi problem
14. Write a program to implement simple queue operations using an array.
15. Write a program to implement circular queue operations using a linked list.

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101CC105/ 102CC105	Operating Systems	3L:0T:0P	3 Credits

Course Outcomes:

CO1 : Understand the general concept of operating systems
CO2 : Know about types of system software and their functions
CO3 : Understand different types and structures of operating systems
CO4 : Understand different functions of operating systems
CO5 : Know about open-source operating systems

Course Content:

UNIT-I	**Operating Systems Overview:** Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems. **Operating Systems Structures:** Operating system services and systems calls, system programs, operating system structure, operating systems generations. **(12 Hrs.)**
UNIT-II	**Process Management:** Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads. **Process Scheduling:** Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR) , Performance evaluation of the scheduling Algorithms **(11 Hrs.)**
UNIT-III	**Process Synchronization:** Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors. **Deadlocks:** System model, dead lock characterization, dead lock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks. **(11 Hrs.)**
UNIT-IV	**Memory Management :** Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation. **Virtual Memory :** Demand paging, Page Replacement algorithms, Allocation of frames, thrashing. **I/O Management :** Principles of I/O Hardware : Disk structure, Disk scheduling algorithms. **(11 Hrs.)**

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles,7th edition O R Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.

2. SumitabhaDas,UNIXConceptsandApplications,4thEdition,TataMcGraw-Hill.

Course Outcomes(COs):

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

CO1 : Explain the fundamentals of the operating system.

CO2 : Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management.

CO3 : Compare the performance of CPU scheduling algorithms

CO4 : Identify the features of I/O and File handling methods.

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101SEC103/ 102SEC103	Web Technologies	1L:0T:0P	1 Credits

Course Objectives

    CO1.   Knowledge about actual working of WWW.
    CO2.   Ability to create web page by integrating multimedia.
    CO3.   Get familiar to plan a responsive website.
    CO4.   Knowledge to Publish site with Search Engine Optimization.
    CO5.   Acquire the professional knowledge of Web Programming required for Industry

Course Content:

UNIT-I	Introduction to Web Publishing, Anatomy of Website, Wire framming your website, web hosting, Basics of HTML & CSS, Creating Web Pages, organizing information with lists, working with Links **(8 Hrs.)**
UNIT-II	Formatting Text with HTML and CSS, Using CSS to Style a Site, Using images on web pages, Building tables Using CSS to position elements on the page, Designing Forms, Structuring page with HTML 5 **(7 Hrs.)**
UNIT-III	Integrating Multimedia: Video and Sound, Advance CSS: Page layout in CSS, Using Responsive Web Design Introducing JavaScript, JQuery, Use of JavaScript, working with Frames & Linked Windows, Designing for the Mobile Web, Designing for user experience**. (8 Hrs.)**
UNIT-IV	Live on the Web, Publishing the site, Taking advantage of Server, Search Engine & Search Engine Optimization **(7 Hrs.)**

Course Outcomes:

    1.   Knowledge about actual working of WWW.
    2.   Ability to create web page by integrating multimedia.
    3.   Get familiar to plan a responsive website.
    4.   Knowledge to Publish site with Search Engine Optimization.
    5.   Acquire the professional knowledge of Web Programming required for Industry

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101LabSEC103/ 102LabSEC103	Web Technologies	0L:0T:2P	1 Credits

Practical list of Programs:

1. Create your class time table using table tag.
2. Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags.
3. Create web page using Frame with rows and columns where we will have header frame, left frame, right frame, and status bar frame. On clicking in the left frame, information should be displayed in right frame.
4. Create Your Resume using HTML, use text, link, size, color and lists.
5. Create a Web Page of a supermarket using (internal CSS)
6. Use In line CSS to format your resume that you have created.
7. Use External CSS to format your time table created.
8. Use all the CS (inline, internal and external) to format college web page that you have created.
9. Write a HTML Program to create your college website using for mobile device.
10. Write an HTML/Java Script page to create log in page with validations.
11. Develop a Simple calculator for addiction, subtraction, multiplication and division operation using JavaScript.
12. Use Regular Expressions for validations in Login Page using JavaScript.
13. Write a Program to retrieve date from a textfile and displaying it using AJAX.
14. Create XML file to store Student Information like Register Number, Name, Mobile Number, DOB, and Email-Id.

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101SEC102/ 102SEC102	Object Oriented Programming using Java	3L:0T:0P	3 Credits

Course Objectives

CO1: To introduce the object oriented programming system concepts
CO2: To introduce syntax and semantics of Java programming language
CO3: To develop modular programs using Java
CO4: To setup JDK environment to create, debug and run Java programs

Prerequisite: Knowledge of Problem Solving Techniques using C programming language

Course Content:

UNIT-I	**Fundamentals of Object Oriented Programming:** Basic Concepts of Object Oriented Programming (OOP),Benefits and Applications of OOP. **Java Evolution:** Java Features, Difference between Java, C and C++, Java and Internet, Java Environment. **Overview of Java Language:** Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program And JVM, Command Line Arguments **(12 Hrs.)**
UNIT-II	**Constants, Variables and Data Types:** Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Type casting. **Operators & Expressions:** Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity. **Decision Making, Branching & Looping:** Decision Making with Control Statements, Looping statements, Jumpin loops, Labelled loops. **(11 Hrs.)**
UNIT-III	**Classes, Objects and Methods:** Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance **Arrays, Strings and Vectors:** 1D arrays, Creating an Array, 2D arrays, Strings, Vectors, Wrapper Classes, Enumerated Types **Inheritance:** Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism **(11 Hrs.)**
UNIT-IV	**Packages:** Basics of packages, System packages, Creating and accessing packages, Creating user defined packages, Adding class to a package. **Exception Handling:** Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions **Applet Programming:** Applet Basics, Applet Life Cycle, Applet Implementation and Applications. **(11 Hrs.)**

Text Books

1. Balaguruswamy E.(2023).Programming with JAVA: APrimer.7th edition. India : Mc Graw Hill Education

2. Schildt, H.(2022).Java:The Complete Reference.12th edition. McGraw-Hill Education.

Reference Books

3. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.

4. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited,2015.

5. Y. Daniel Liang, Introduction to Java Programming,7th Edition, Pearson, 2008.

6. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

Web Resources

1. https://www.w3schools.com/java/.
2. http://www.java2s.com/.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

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101LabSEC102/ 102LabSEC102	Object Oriented Programming using Java	0L:0T:4P	2 Credits

List of Practical:

1. Write a program to read two numbers from user and print their product.
2. Write a program to print the square of a number passed through command line arguments.
3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
4. Write a java program to find the largest number out of n natural numbers.
5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non-recursive functions.
6. Write a java program to multiply two given matrices.
7. Write a Java program for sorting a given list of names in ascending order.
8. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
9. Write a java program to read n number of values in an array and display it in reverse order.
10. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from Add Subclass to use the member data of the superclass. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. Create a JAVA class called Student with the following details as variables within it.
12. USN, NAME, BRANCH, PHONE, PERCENTAGE
13. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.
14. Write a Java program that displays the number of characters, lines and words in a text.
15. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea().
16. Create a sub class called Circle that overrides the getPerimeter() and getArea()

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101VAC102/ 101VAC102	Indian Constitution	2L:0T:0P	2 Credits

Course Content:

UNIT-I	• The Constitution - Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles. **(8 Hrs.)**
UNIT-II	• Union Government • Structure of the Indian Union • President–Role and Power • Prime Minister and Council of Ministers • Lok-Sabha and Rajya-Sabha. **(7 Hrs.)**
UNIT-III	• State Government • Governor–Role and Power • Chief Minister and Council of Ministers • State Secretariat. . **(8 Hrs.)**
UNIT-IV	• Administration • District Administration • Municipal Corporation • Zila Panchayat • Role and Functioning • Chief Election Commissioner • State Election Commission. **(7 Hrs.)**

Suggested Learning Resources:
1. Ethics and Politics of the Indian Constitution by Rajeev Bhargava, Oxford University Press, New Delhi, 2008
2. The Constitution of India by B. L. Fadia Sahitya Bhawan ; New edition(2017)
3. Introduction to the Constitution of India by D D Basu Lexis Nexis; Twenty-Third, 2018 edition

Suggested Software / Learning Websites:
a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

Cases

● Rustom Cavasjee Cooper v. Union of India, (1970)1SCC 248
● State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068 (confirmation of a private monopoly, not a violation of fundamental right)
● Mithilesh Garg v. Union of India, (1992)1 SCC 168 : AIR 1992 SC221(Right to carry on business, not breached when it is liberalised)

- Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118 (scope of reasonable restrictions in relation to trade and occupation)
- Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC220(the reasonableness of the restriction imposed may depend upon the nature of the business and prevailing conditions including public health and morality)
- T. B. I brahim v. Regional Transport Authority. Tanjore, AIR1953SC79
- Harman Singh v. RTA, Calcutta, AIR 1954SC190
- DwarkaPrasad LaxmiNarain v. State of U.P., AIR 1954SC224
- State of Bombay v. R. M. D. Chamarbaugwala, AIR 1957SC699
- Parbhani Transport Coop. Society Ltd. v. Regional Transport Authority, Aurangabad, AIR1960 SC801
- State of Bombay v. R. M. D. Chamarbaugwala, (1957)S.C.R.874,
- G. K. Krishnan vs State of TamilNadu, 1975 SCC (1)375
- Automobile Transport (Rajasthan) Ltd. Vs State of Rajasthan, AIR1962SC1406

Course Outcome(s):

Upon completion of this course, students will be able to:

1. Constitutional Framework: Analyze the Indian Constitution's history, Preamble, Fundamental Rights, and basic structure.
2. Union Government Structure: Describe the roles of the President, Prime Minister, and the legislative bodies (LokSabha and RajyaSabha).
3. State Government Mechanisms : Examine the powers of the Governor, Chief Minister, and the State Secretariat.
4. Local Administration: Assess the functioning of local government bodies like District Administration, Municipal Corporations, and Zila Panchayats.
5. Electoral Processes: Analyze the role of the Election Commission in conducting free and fair elections.
6. Application of Knowledge: Apply constitutional principles to contemporary political issues and evaluate governance effectiveness.

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SEMESTER III

101CC201/ 102CC201	Probability and Statistics	3L:0T:0P	3 Credits

Course Objectives

CO1: This course aims to make the students trained to handle randomness scientifically using theory of probability.

CO2: This course intends to make the students able to represent the statistical data in a systematic way and analyze it to draw meaningful information from them.

CO3: Through plentiful examples and exercises, this course provides the students scope to apply probabilistic and statistical techniques to deal with the real-life problems.

Course Content:

UNIT-I	**Concepts of probability:** Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability. **Random Variables:** Discrete and continuous random variable, probability distribution of a random variable, probability mass function, probability density function, expectation andvariance of a random variable. **Standard Probability Distributions:** Binomial probability distribution, Poisson probability distribution, Normal probability distribution. **(12 Hrs)**
UNIT-II	**Sampling Distribution:** Concept of Population and Sample, parameter and statistic, samplingdistribution of sample mean and sample proportion. **Statistical Inference:** Estimation and Hypothesis Testing (only concept). **Hypothesis Testing for a Single Population:** Concept of a hypothesis testing, tests involvinga population mean and population proportion (z test and t test). **(11 Hrs)**
UNIT-III	Basic concepts of Statistics, qualitative and quantitative data, classification of data, constructionof frequency distribution, diagrammatic representation of data. **Measures of Central Tendency**: Arithmetic mean, median and mode—their properties **Measures of Dispersion**: Range, mean deviation, quartile deviation, variance and standard deviation. **(11 Hrs)**
UNIT-IV	**Correlation:** Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. **Regression**: Linear regression-fitting by least square method and interpretation. Regression Table: P-value, R-squared **(11 Hrs)**

Text Books

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna BookPublishing Company, 2010 (AICTE Recommended Textbook)

2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.

3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.

4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

Reference Books

1. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013

2. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.

3. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

Web Resources
1. https://nptel.ac.in/courses/111106112
2. https://nptel.ac.in/courses/111105041

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101CC202/ 102CC202	**Database Management System**	**3L:0T:0P**	**3 Credits**

Course Objectives

CO1: Understanding Core Concepts of DBMS

CO2: Proficiency in Database Design and SQL

CO3: Application of Advanced Database Techniques

Prerequisite: Basic knowledge of Set Theory.

Course Content:

UNIT-I	**Introduction to Databases**: Definition of Data, Database, and DBMS, Overview of DatabaseApplications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators **Data Models:** Introduction to Data Models, Data Model Classification (Hierarchical, Network, Relational, Object-oriented), Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, and Weak Entity Sets, **Database Design**: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key,Alternate Key, Unique Key, Surrogate Key, Key Constraints, Introduction to the Relational Model and Relational Schema Design. **(12 Hrs.)**
UNIT-II	**Normalization and Database Design**: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization. **Database Storage and Indexing**: Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection **(11 Hrs.)**
UNIT-III	**Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Joins in SQL, (Inner Join, NaturalJoin, Full Outer Join, Left Outer Join, Right outer Join, Equi Join). **(11 Hrs.)**
UNIT-IV	**Transaction Management**: Introduction, ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Serializability and Recoverability, Introduction to Lock Management, Lock-Based Concurrency Control, Performance of Locking, Dealing with Deadlocks, Transaction Support in SQL, Introduction to Crash Recovery, Strict 2PL, ARIES algorithm. **(11 Hrs.)**

Text Books

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hrs.", 1st edition, Sams Publishing, 2024

Reference Books

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.(2019)
2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

Web Resources

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexd/domain/dev-community/category/sql_and_pl_sql
3. https://asktom.oracle.com/ords/f?p=100:1:0

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101LabCC202/ 102LabCC202	Database Management System	0L:0T:4P	2 Credits

List Of Practical's

1. Draw an ER Diagram of Registrar Office
2. Draw an ER Diagram of Hospital Management System
3. Reduce The ER diagram in question no 1 into tables
4. Reduce the ER diagram of question no 2 into tables
5. Consider the following Schema (DDL Commands)
   Supplier(SID, Sname, branch, city, phone)
   Part(PID, Pname, color, price)
   Supplies(SID, PID, qty, date_supplied)
   - I.   Create the above tables
   - II.   Add a new attribute state in supplier table
   - III.   Remove attribute city from supplier table
   - IV.   Modify the data type of phone attribute
   - V.   Change the name of attribute city to address
   - VI.   Change a table's name, supplier to sup
   - VII.   Use truncate to delete the contents of supplies table
   - VIII. Remove the part table from database

6. DML Commands
   - i.   Insert at least 10 records in tables supplier, part and supplies
   - ii.   Show the contents in tables supplier, part and supplies
   - iii.   Find the name and city of all suppliers
   - iv.   Find the name and phoneno of all suppliers who stay in 'Delhi'
   - v.   Find all distinct branches of suppliers
   - vi.   Delete the record of the supplier whose SID is 204001
   - vii.   Delete all records of supplier table
   - viii. Delete all records of suppliers whose city starts with capital A.
   - ix.   Find the supplier names which have 'lk' in any position
   - x.   Find the supplier name where 'R' is in the second position
   - xi.   Find the name of supplier whose name starts with 'V' and ends with 'A'
   - xii.   Change the city of all suppliers to 'BOMBAY'
   - xiii. Change the city of supplier 'Vandana' to 'Goa'

7. Queries with Constraints
   - I.   Create the supplier table with Primary Key Constraint
   - II.   Create supplies table with Foreign key Constraint
   - III.   Create a part table with UNIQUE Constraint
   - IV.   Create supplier Table with Check Constraints
   - V.   Create Supplier table with Default Constraint

9. Aggregate Functions:

1. Find the minimum, maximum, average and sum of costs of parts
2. Count the total number of parts present

3.   Retrieve the average cost of all parts supplied by 'Mike'

10. Queries on GROUP BY, HAVING AND ORDER BY Clauses
   1.   Display total price of parts of each color
   2.   Find the branch and the number of suppliers in that branch for branches which have morethan 2 suppliers
   3.   Find all parts sorted by pname in ascending order and cost in descending order
   4.   Find the branch and the number of suppliers in that branch

11. Queries on Operators
   1.   Find the pname, phoneno and cost of parts which have cost equal to or greater than 200and less than or equal to 600.
   2.   Find the sname , SID and branch of suppliers who are in 'local' branch or 'global' branch
   3.   Find the pname, phoneno and cost of parts for which cost is between 200 and 600
   4.   Find the pname and color of parts , which has the word 'NET' anywhere in its pname.
   5.   Find the PID and pname of parts with pname either 'NUT' or 'BOLT'
   6.   List the suppliers who supplied parts on '1st may2000', '12 JAN 2021' ,'17 dec 2000','10 Jan 2021'
   7.   Find all the distinct costs of parts

12. Join Operators
   1.   Perform Inner join on two tables
   2.   Perform Natural Join on two tables
   3.   Perform Left Outer Join on tables
   4.   Perform Right Outer join on tables
   5.   Perform Full Outer Join on tables

13. Set Theory Operators
   1.   Show the use of UNION operator with union compatibility
   2.   Show the use of intersect operator with union compatibility
   3.   Show the use of minus operator with union compatibility
   4.   Find the cartesian product of two tables

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101SEC201/ 102SEC201	Python Programming	2L:0T:0P	2 Credits

Course Objectives:
CO1: Develop modular Python programs.
CO2: Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.
CO3: Understand basic Data visualization and File handling in Python.

Prerequisites:
Understanding of Problem-solving techniques using a programming language and basic datastructures.

Course Content:

UNIT-I	Introduction: History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements. Strings: Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings. Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit. **(12 Hrs.)**
UNIT-II	Functions: Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module; Mutable and Immutable objects: Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays. **(11 Hrs.)**
UNIT-III	Files: Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files. Exception Handling: Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions. Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves. **(11 Hrs.)**
UNIT-IV	Object-Oriented Programming, Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism. **(11 Hrs.)**

Text Books:
1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, KhannaPublishing House, 2023.
3. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modularapproach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

Reference Books:
1. Think Python, by Allen Downey, 2nd edition, 2015, O'Reilly.

https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-Q-LE2_p4YvMk5cIg/view
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2nd edition, 2016, PHI India.

Web Resources:
1. https://www.learnpython.org/
2. https://www.w3schools.com/python/default.asp

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101LabSEC201/ 101LabSEC201	Python Programming	0L:0T:4P	2 Credits

Practical List:

1. Write a program to find whether a number is a prime number.
2. Write a program to print m raise to power n, where m and n are read from the user.
3. Write a program having a parameterized function that returns True or False depending onwhether the parameter passed is even or odd.
4. Write a program to print the summation of the following series up to n terms: 1-2+3-4+5-6+7…..n
5. Write a menu driven program to perform the following operations on strings using stringbuilt in functions.
   a. Find the frequency of a character in a string.
   b. Replace a character by another character in a string.
   c. Remove the first occurrence of a character from a string.
   d. Remove all occurrences of a character from a string.
6. Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
7. Using Numpy module write menu driven program to do following
   a. Create an array filled with 1's.
   b. Find maximum and minimum values from an array
   c. Dot product of 2 arrays.
   d. Reshape a 1-D array to 2-D array.
8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
9. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
   a. Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line.
   b. Print all even values of t1 as another tuple t2.
   c. Concatenate a tuple t2=(11,13,15) witht1.
   d. Return maximum and minimum value from t1..
10. Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.
11. Write a Python program to handle a Zero Division Error exception when dividing a number by zero.
12. Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
13. Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.
14. Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label name = Month Number and Y axis label name = Total profit.

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101CC203/ 102CC203	Software Engineering	3L:0T:0P	3 Credits

Course Objectives

CO1: To Acquire a comprehensive understanding of the software development lifecycle andits application in contemporary software engineering practices.

CO2: To Develop proficiency in project management methodologies and strategic decision-making for successful software project execution.

CO3: To Master the art of software design, development, and testing to produce robust andefficient software solutions.

Prerequisites: Basic understand of Software, Applications, Programming fundamentals.

Course Content:

UNIT-I	The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.
	Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process. **(12 Hrs.)**
UNIT-II	**Software Requirements Engineering**: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.
	Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, riskprojection, risk refinement, RMMM, RMMM plan.
	Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques. **(11 Hrs.)**
UNIT-III	**Design:** Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
	Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
	Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance. **(11 Hrs.)**
UNIT-IV	**Quality Management**: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.
	Release Management: Release planning, development and build plans, release strategies, riskmanagement, and post-deployment monitoring.

	Product sustenance: Maintenance, updates, End of life, migration strategies. **(11 Hrs.)**

Text Books

1. Software Engineering, N.S. Gill, Khanna Publishing
   House, 2023 (AICTERecommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce
   R. Maxim. McGraw Hill Education, 2015.

Reference Books

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

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101DSE201	Feature Engineering	1L:0T:0P	1 Credits

Course Content:

UNIT-I	Introduction to Feature Engineering
	Introduction to Data and Features: Importance of Features in Machine Learning. Data types and features: Numerical, Categorical, Ordinal, Discrete, Continuous, Interval and Ratio.
	Basic Feature Preprocessing : Handling Missing Data, Data Cleaning, Feature Scaling, Normalization, and Transformation. **(8 Hrs.)**
UNIT-II	**Feature Engineering Techniques**
	Techniques for Numerical Data : Binning and Discretization, Polynomial and Interaction Features. Categorical Data Techniques : One Hot Encoding, Label Encoding. Feature extraction vs. feature selection, Steps in feature selection. Feature Selection Methods: Filter, Wrapper, and Hybrid. Feature Reduction : Introduction and application of Principal Components Analysis. **(7 Hrs.)**

Text Books
1. M. C. Trivedi, Data Science and Data Analytics Using Python Programming, Khanna Publishing House, 2024.
2. Zheng, Alice, & Casari, Amanda. (2018). Feature engineering for machine learning : Principles and techniques for data scientists. O'Reilly Media, Inc.
3. Kalita, J. K. , Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science : Theory and Practice. Elsevier. ISBN-13: 9780323917780.

Reference Books:
1. Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.
2. N.Bhaskar, Vasundhara, Machine Learning, Khanna Publishing House, 2024.
3. M. C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024.
4. Ng, Andrew. (2018). Machine learning yearning (Draft, MITLicensed). GitHub.ISBN-10:199957950X, ISBN-13: 978-1999579500.
5. Han, Jiawei, Kamber, Micheline, & Pei, Jian.(2011). Datamining: Concepts and techniques(3rded.). Morgan Kaufmann Publishers. ISBN978-0123814791.
6. Tan, Pang-Ning, Steinbach, Michael, Karpatne, Anuj, & Kumar, Vipin.(2021). Introduction to datamining(2nd ed.). Pearson. ISBN978-9354491047.
7. Provost, Foster, & Fawcett, Tom. (2013). Data science for business: What you need to know about data mining and data-analytic thinking. O'ReillyMedia, Inc.
8. Galli, Soledad. (2020). Python feature engineering cookbook : Over 70 recipes for creating, engineering, and transforming features to build machine learning models. Packt Publishing, Limited.
9. Nielsen, Aileen. (2019). Practicaltime seriesanalysis : Prediction with statistics and machine learning. O'Reilly Media.
10. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2024.
11. Jeeva Jose, Machine Learning, Khanna Publishing House, 2024.

12. Chollet, François. (2017). Deep learning with Python. Manning Publications. ISBN9781617294433.

Course Outcomes

CO1: Understand the importance of features in machine learning and differentiate between various types of data and features (structured vs. unstructured, categorical, numerical, text, and date-time).

CO2: Apply basic feature preprocessing techniques such as handling missing data, data cleaning, and feature scaling and normalization.

CO3: Implement feature engineering techniques for numerical data, including binning, discretization, polynomial and interaction features, and log transformation.

CO4: Utilize categorical data techniques, such as one-hot encoding and label encoding, and understand features election methods, including filter and wrapper methods.

CO5: Perform feature transformation using techniques like Principal Component Analysis(PCA) and understand its application in machine learning.

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101LabDSE201	Feature Engineering	0L:0T:4P	2 Credits

LAB Experiments

The lab experiments can be implemented in Python using relevant libraries such as numpy, pandas, sklearn, nltk, matplotlib, and seaborn. Kaggle datasets, public repositories (e.g., UCI, Machine Learning etc.), or generated data sets can be used for conducting the experiments. Experiments may be conducted on numerical, image, or time-series datasets.

Suggested list of Experiments (not limited to):
1. Handle missing values in column(s) of a dataset. For example, fill missing values with the mean / median / mode of the columns such as 'Age', 'Height', 'Weight', 'Grade' for a dataset.
2. Clean a dataset by identifying and removing invalid data entries. For example, a dataset having columns 'Name', 'Gender' and 'Age' where 'Name' contains 'invalid data'.
3. Scale numerical features using Min-Max normalization for a dataset with columns like 'Height', 'Weight'.
4. Perform exploratory data analysis and visualize data distributions using histograms and boxplots.
5. Compute and visualize the correlation matrix of a dataset with 2 or more columns.
6. Create polynomial and interaction features from numerical data in a dataset with two columns.
7. Apply logarithmic transformation to skewed numerical features in a dataset with column 'Distance'.
8. Perform one-hot encoding on categorical features in a dataset with column 'Category' containing categorical values. The distinct values in the Category feature are [Good, Better, Best]and Gender[Male, Female].
9. Preprocess text data(tokenization)for a data set with a column 'Text'.
10. Preprocess text data(stemming) for a data set with a column 'Text'.
11. Preprocess text data(lemmatization)for a dataset with a column 'Text'.
12. Converttextdataintoa Bag-of-Words representation for a dataset with a column 'Text'.
13. Apply TF-IDF transformation to text data for a column 'Text'.
14. Perform image augmentation (resizing, normalization, rotation, translation) for a set of images.
15. Perform image augmentation resizing for a set of images.
16. Perform image augmentation normalization for a set of images.
17. Perform image augmentation rotation for a set of images.
18. Perform image augmentation translation for a set of images.
19. Decompose a time series into trend, seasonal, and residual components for a data set with a column 'Time Series'.
20. Perform Principal Component Analysis (PCA) on a data set and visualize the first two principal components.

Course Outcomes
CO1: Demonstrate proficiency in handling and preprocessing missing data, including filling missing values and cleaning invalid data entries.
CO2: Apply feature scaling techniques, such as Min-Max normalization, and perform exploratory data analysis through data visualization methods like histograms and boxplots.
CO3: Implement feature engineering techniques, including binning, polynomial feature creation, and logarithmic transformations on numerical data.
CO4: Perform text data preprocessing tasks, such as tokenization, stemming, lemmatization,

and apply TF-IDF and Bag-of-Words transformations.

CO5: Apply image and time series data augmentation and decomposition techniques to enhance and analyze image and time series data.

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102DSE201	Basics of Data Analytics using Spreadsheet	1L:0T:0P	1 Credits

Course Objectives:
CO1: Understand the basics of data analytics and its applications.
CO2: Develop proficiency in using spreadsheet software for data manipulation and analysis.
CO3: Build and use spreadsheet models for decision making & Communicate data insights effectively

Prerequisite: Knowledge on basics of mathematical & Statistical concepts such as arithmetic, percentages, averages, and basic algebra.

Course Content:

UNIT-I	Introduction to Data Analytics
	Understanding data and its types (structured, unstructured, semi-structured)- What is Data Analytics-Types of data Analytics - Importance of Data Analytics - Applications of Data Analytics. **(8 Hrs.)**
UNIT-II	Data, Ethics, and Industry : Case Studies
	Data Collection Methods - Different Data Sources & format - Data Cleaning and Transformation-Handling Missing Data and Outliers - Ethical considerations in data analytics. - Real-world Applications of Data Analytics - Industry - specific applications (finance, marketing, operations) - Case Study **(7 Hrs.)**

Text Books
1. "Beginner's Guide for Data Analysis using R Programming " by Jeeva Jose, Khanna Publishing House, 2024.
2. "Data Analytics" by V. K. Jain, Khanna Book Publishing Company, 2024.
3. "Excel Data Analysis For Dummies " by Stephen L. Nelson and E. C. Nelson, John Wiley & Sons; 3rd edition, 2016
4. "Data Analysis Using Microsoft Excel " by Michael R. Middleton, Thomson, Brooks / Cole, 3rd edition, 2004

Reference Books
1. "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach, John Wiley & Sons, 25 Sept 2018
2. "Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics" by Cliff T Ragsdale, Cegage learning asia pet. 2015
3. "Mastering Excel " by Web Tech Solutions, Khanna Publishing House, 2024.

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102LabDSE201	Basics of Data Analytics using Spreadsheet	0L:0T:4P	2 Credits

Lab Program List

Introduction to Excel and Basic Functions
1. Getting started with Excel : Workbook, Worksheet, Cells, and Ranges
2. Data entry and basic formatting techniques
3. Using basic arithmetic functions : SUM, AVERAGE, MIN, MAX, ROUND
4. Introduction to cell referencing : relative, absolute, and mixed

Data Importing and Pre-processing
1. Importing data from various sources (CSV, textfiles, webdata)
2. Data cleaning : removing duplicates, handling missing data, and standardizing formats
3. Data transformation : text-to-columns, data validation techniques
4. Using the "Find & Replace" and "Text Functions" (LEFT, RIGHT, MID, CONCATENATE)

Descriptive Statistics Using Excel
1. Calculating measures of central tendency : mean, median, mode
2. Computing measures of dispersion : range, variance, standard deviation
3. Creating and interpreting frequency distributions and histograms
4. Using Excel's "Data Analysis Toolpak" for basic statistical analysis

Advanced Spreadsheet Functions
1. Using logical functions : IF, AND, OR, IF ERROR
2. Lookup and reference functions : VLOOKUP, HLOOKUP, INDEX, MATCH
3. Data aggregation techniques : SUMIFS, COUNTIFS, AVERAGE IFS
4. Text functions for datamanipulation : TRIM, CLEAN, TEXT, RIGHT, LRFT, MID

Data Visualization Techniques
1. Creating various chart types : bar, line, pie, scatter
2. Advanced charting techniques : combocharts, dual-axis charts
3. Data visualization best practices : choosing the right chart, formatting, and styling
4. Creating and customizing Pivot Tables and Pivot Charts

Dashboard Creation
1. Introduction to dashboards : concepts and components
2. Using Pivot Tables and Pivot Charts for dashboard elements
3. Applying conditional formatting for dynamic visual cues
4. Creating interactive dashboards with slicers and timeline

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101LabVAC201/ 102LabVAC201	Yoga and Physical fitness/Sports/ NCC /NSS/ Disaster Management	0L:0T:4P	2 Credits

Note: All the theoretical contents shall be delivered through the practical workshop modeonly. No class room teaching is encouraged in this course.

YOGA

Yoga course is designed to provide students with a comprehensive understanding of physical fitness, wellness, and nutrition. This course explores the meaning and importance of yoga in themodern era, the role of sports in maintaining physical fitness, and the various components of physical wellness. Students will also learn about the significance of nutrition and weight management, equipping them with the knowledge to promote a healthy and balanced lifestyle. Through this course, students will gain insights into the holistic approach to health and well- being.

Course Objective(s):
i. Understand yoga's significance and its practical applications for holistic well-being.
ii. Explore subtle energy systems and their role in enhancing health through yogic practices.
iii. Examine various paths of yoga to foster self-realization and spiritual growth.
iv. Master the Eight Limbs of Yoga for physical, mental, and spiritual harmony.
v. Apply yogic principles to manage psycho-somatic ailments and promote resilience.

Course Content:

Unit-I (8 Hrs.)
● Yoga: Meaning and definition
● Importance of yoga in 21st century
● Introduction to Yogic Anatomy and Physiology
● Yoga & sports, Yoga for healthy lifestyle
● Types of Yoga: - Hatha yaga, laya yoga, mantra yoga,
● bhakti yoga, karma yoga, jnana yoga, raj yoga
● Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices.
● Ashtang Yoga: - Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyan, Samadhi : Benefits, Utilities & their psychological impact on body and mind. According to yogaconcept of normality in modern psychology, concept of personality & its development, yogic management of psycho-somatic ailments: frustration, anxiety, depression

Unit- 2 (7 Hrs.)
● Sports for Physical Fitness: Meaning and definition
● Physical Activity – Concept, Benefits of Participation in Physical Activities
● Components and Significance of Physical Fitness -Health, Skill and Cosmetic Fitness
● Types of Physical Activities – Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports
● Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness

- Measurement of Health Related Physical Fitness (HRPF)

Unit -3   **(8 Hrs.)**
- Physical Wellness: Concept, Components
- Types of wellness: psychological, social, emotional, and spiritual.
- Significance with reference to Positive Lifestyle 2.2
- Concepts of Quality of Life and Body Image
- Factors affecting Wellness
- Wellness Programmes

Unit-4: Nutrition and Weight Management   **(7 Hrs.)**
- Concept of Nutrients, Nutrition, Balanced Diet, Dietary Aids and Gimmicks
- Energy and Activity- Calorie Intake, Energy Balance Equation
- Obesity - Concept, Causes, Obesity Related Health Problems
- Weight Management through Behavioural Modifications

Text Books / References:
- Anand O P. Yog Dawra Kaya Kalp. Sewasth Sahitya Perkashan. Kanpur.
- Brown, J.E. Nutrition Now Thomson-Wadsworth.
- Corbin et.al.Fitness & Wellness-Concepts. McGraw Hill. Publishers. New York.U.S.A
- Corbin, C. B., G. J. Welk, W. R Corbin, K. A. Welk, Concepts of Physical Fitness: Active Lifestyle for Wellness. McGraw Hill, New York, USA.
- Hoeger, W W K and S.A. Hoeger. Principles and Labs for Fitness and Wellness, Thomson Wadsworth, California, USA.
- Hoeger, W.W. & S. Hoeger   Fitness and Wellness. 7th Ed. Thomson Wadsworth, Boston, USA.
- Kamlesh, M. L. & Singh, M. K.) Physical Education (Naveen Publications).
- Kansal, D.K. Text book of Applied Measurement, Evaluation & Sports Selection. Sports & Spiritual Science Publications, New Delhi.
- Kumari, Sheela, S., Rana, Amita, and Kaushik, Seema,, Fitness, Aerobics and Gym Operations, Khel Sahitya, New Delhi
- Lumpkin, A. Introduction to Physical Education, Exercise Science and Sports Studies, McGraw Hill, New York, U.S.A.
- Sarin N) Yoga Dawara Rogon Ka Upchhar.Khel Sahitya Kendra
- Savard, M. and C. Svec The Body Shape Solution to Weight Loss and Wellness: The Apples & Pears Approach to Losing Weight, Living Longer, and Feeling Healthier. Atria Books, Sydney, Australia.
- Siedentop, D. Introduction to Physical Education, Fitness and Sport, McGraw Hill Companies Inc., New York, USA.
- Sri Swami Ramas. Breathing. Sadhana Mandir Trust.Rishikesh.
- Swami Ram Yoga & Married Life Sadhana Mandir Trust. Rishikesh

Course Outcome(s):
i. Gain a comprehensive understanding of yoga and its modern applications for holistic well-being.

ii.   Demonstrate proficiency in yogic anatomy and physiology, enhancing yoga practice and promoting physical and energetic balance.

iii.   Master the Eight Limbs of Yoga and comprehend their psychological impact, fostering personal growth and self-realization.

iv.   Integrate yoga principles into sports and physical fitness activities to enhance performance and prevent injuries.

v.   Develop skills in wellness management and nutrition

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Sports Management

Sports Management course is designed to provide undergraduate students with a broad, foundational understanding of the dynamic field of sports management. This course will familiarize students with the fundamental principles and concepts of sports management,including its scope, organizational structure, and ethical considerations. Students will gain insights into the roles of marketing and sponsorship in the sports industry, as well as develop proficiency in financial management techniques specific to sports organizations. Additionally, the course will explore the application of analytics and technology in sports, enhancing the strategic decision-making and fan engagement capabilities.

Course Objective(s):

i.   Understand the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations.

ii.   Analyse the role of marketing and sponsorship in the sports industry, with a focus on branding, target audience segmentation, and event management.

iii.   Develop proficiency in financial management techniques specific to the sports industry, including revenue generation, cost management, and investment strategies.

iv.   Explore the application of analytics and technology in sports, including performance evaluation, strategic decision-making, and fan engagement.

v.   Apply theoretical knowledge to practical scenarios through case studies and projects, fostering critical thinking and problem-solving skills in sports management contexts.

Course Content:

Unit 1: Introduction to Sports Management   (8 Hrs.)
- Definition and scope of sports management
- Significance of sports management in society and its evolution over time
- Organizational structure of sports: amateur, professional, and non-profit entities
- Roles and responsibilities of key personnel: managers, coaches, and agents
- Governance bodies in sports: FIFA, IOC, and NCAA
- Legal issues: contracts, negotiations, intellectual property rights
- Ethical considerations: fair play and doping

48

Unit 2: Sports Marketing and Sponsorship (7 Hrs.)
● Unique aspects of sports marketing
● Fan engagement strategies
● Target audience identification and segmentation
● Branding strategies for sports teams and athletes
● Sponsorship and endorsement deals
● Negotiating and managing partnerships
● Event management: planning, organizing, and promoting sports events

Unit 3: Financial Management in Sports (8 Hrs.)
● Revenue generation in sports: ticket sales, broadcasting rights, merchandise sales
● Financial models: budgeting and forecasting
● Cost management: player salaries, facility expenses, operational costs
● Investment opportunities in sports
● Risk management techniques specific to sports organizations

Unit 4: Sports Analytics and Technology (7 Hrs.)
● Introduction to sports analytics
● Evaluating player performance
● Devising game strategies
● Fan engagement through technology
● Analytical techniques: statistical analysis, data visualization, predictive modeling
● Key performance indicators (KPIs) in sports
● Applications of analytics: talent scouting, injury prevention, performance optimization.

Text Books :
1. Pedersen, P. M., Thibault, L., & Pedersen, P. M. (2019). Contemporary SportManagement. Human Kinetics.

2. Hoye, R., Smith, A. C. T., Nicholson, M., et al. (2021). Sports Management: Principlesand Applications. Routledge.
3. Chelladurai, P., & Kerwin, S. (2017). Introduction to Sport Management: Theory and Practice. Human Kinetics.
4. Hoye, R., Cuskelly, G., & Nicholson, M. (2019). Sports Governance: A Guide for Sport Organizations. Routledge.
5. Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
6. Shank, M. D. (2019). Sports Marketing: A Strategic Perspective. Pearson.
7. Collett, P., & Fenton, W. (2019). The Sponsorship Handbook: Essential Tools, Tips and Techniques for Sponsors and Sponsorship Seekers. Kogan Page.
8. Fullerton, S. Jr., & Funk, D. C. (2019). Sports Marketing: A Practical Approach. Routledge.
9. Conrad, M. (2019). Winning in Sports Business: Essential Marketing, Finance, and Management Strategies. Routledge.
10. McCarty, L. A., & McPherson, G. (2019). Sports Event Management: The Caribbean Experience. Routledge.

11. Brown, M. T., Rascher, D., & Leeds, M. A. (2017). Financial Management in the Sport Industry. Routledge.
12. Winfree, J. A., & Rosentraub, M. S. (2017). Sports Finance and Management: Real Estate, Entertainment, and the Remaking of the Business. Taylor & Francis.
13. Foster, G., O'Reilly, N., & Cuskelly, G. (2018). Sports Business Management: Decision Making Around the Globe. Routledge.
14. Brown, M. T., & Shick, D. M. (2019). Financial Management in the Sport Industry. Routledge.
15. Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.
16. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.
17. Miller, T. W. (2019). Sports Analytics and Data Science: Winning the Game with Methods and Models. FT Press.
18. Marchi, M., Albert, J., & Baumer, B. (2014). Analyzing Baseball Data with R. Chapman and Hall/CRC.
19. Schumaker, R. P., Hwang, R. S. Y., & Chen, H. (2016). Sports Data Mining. Routledge.
20. Alamar, B. C. (2013). Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers. Columbia University Press.

References:

Course Outcome(s):

i. Demonstrate a comprehensive understanding of sports management principles, including organizational structures, legal issues, and ethical considerations.
ii. Evaluate marketing strategies and sponsorship opportunities in the sports industry, devising effective branding and promotional campaigns.
iii. Apply financial management techniques to analyze revenue streams, control costs, and make informed investment decisions in sports organizations.
iv. Utilize sports analytics tools and technology to enhance performance evaluation, strategic planning, and fan engagement initiatives.
v. Synthesize course concepts through practical applications, demonstrating the ability to address real-world challenges in sports management scenarios.

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National Cadet Corps (NCC)

This course develops essential skills in discipline, leadership, and tactical operations through structured curriculum and practical exercises. It emphasizes the role of drills in fostering discipline, leadership, and teamwork, and includes comprehensive weapon handling training with a focus on safety protocols. The course teaches map reading, understanding topographical features, and navigating diverse terrains. Practical units cover the history and objectives of the National Cadet Corps (NCC), various maneuvers, parade formations, saluting protocols, and field and battlecraft techniques. By the end, learners will master discipline, leadership, weapon handling, and tactical decision-making, effectively utilizing terrain features for strategic

advantages.

Course Objective(s):

1. Understand the foundational role of drill in fostering discipline and leadership within a group, enabling effective command towards achieving common goals.
2. Appreciate the importance of grace and dignity in executing foot drill movements, recognizing their significance in enhancing performance and teamwork.
3. Comprehend the criticality of weapon handling and detailed safety measures, emphasizing the importance of accident prevention through strict adherence to safety protocols.
4. Develop an awareness of diverse terrain types and their strategic significance in battle craft, enabling informed decision-making and effective utilization of terrain features for tactical advantage.

Course Content (Practical):
Unit 1:
Overview of NCC, its history, aims, objectives, and organizational structure, Incentives and duties associated with NCC cadetship; Maneuvers: Foot drill, Word of Command, Attention, and stand at ease, and Advanced maneuvers like turning and sizing; Parade formations: Parade line, open line, and closed line; Saluting protocols, parade conclusion, and dismissal procedures. Marching styles: style march, double time march, and slow march   **(8 Hrs.)**

Unit 2:
Weapon Training, Handling firearms, Introduction and characteristics of the .22 rifle; Handling Firearm techniques, emphasizing safety protocols and Best practices.   **(7 Hrs.)**

Unit 3:
Map Reading (MR): Topographical forms and technical terms, including relief, contours, and gradients, crucial for understanding terrain features; Cardinal points , magnetic variation and grid convergence   **(8 Hrs.)**

Unit 4:
Field Craft & Battle Craft (FC & BC): Fundamental principles and techniques essential for effective field and battle craft operations; Methods of judging distance, including estimation, pacing, and visual cues   **(7 Hrs.)**

References:
● DGNCC Cadet's Hand Book - Common Subjects -All Wings
● Tiwari, R. (2019). NCC: Grooming Feeling of National Integration, Leadership and Discipline among Youth. Edwin Incorporation.
● Chhetri, R.S. (2010). Grooming Tomorrows Leaders, The National Cadet Corps.
● Directorate General National Cadet Corps (2003). National Cadet Corps, Youth inAction.
● Vanshpal, Ravi (2024). The NCC Days, Notion Press.

Course Outcome(s):
1. Mastery of Discipline and Leadership through Drill Learners would demonstrate the ability to effectively command a group, foster discipline, and work collaboratively towards achieving shared objectives.
2. Mastery of Grace and Dignity in Foot Drill Performance Learners would demonstrate an understanding of how these qualities enhance performance and foster teamwork within a group setting.
3. Proficient Weapon Handling and Safety Adherence Learners would showcase a thorough understanding of the criticality of safety measures, emphasizing accident prevention through strict adherence to safety protocols.
4. Enhanced Tactical Awareness and Strategic Decision-Making Learners would gain the ability to make informed decisions and effectively utilize terrain features to gain tactical advantage during operations.

<p align="center">**********</p>

National Service Scheme (NSS)

This course provides students with an in-depth understanding of the National Service Scheme (NSS), including its history, philosophy, aims, objectives, and organizational structure. It equips students with knowledge about various NSS programmes and activities, emphasizing their relevance and importance. The course also develops skills in community mobilization, teaching students effective techniques for engaging and mobilizing community stakeholders. Additionally, it cultivates an appreciation for volunteerism and shramdan (voluntary labor), highlighting their role in community development initiatives. By the end of the course, students will have a comprehensive understanding of NSS, enhanced leadership and team-building skills, and a strong sense of social awareness and patriotism.

Course Objective(s):
1. To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS).
2. To familiarize students with the aims, objectives, and organizational structure of NSS.
3. To equip students with knowledge about NSS programmes, activities, and their relevance.
4. To develop an understanding of community mobilization techniques and their importance in NSS activities.
5. To cultivate an appreciation for volunteerism, shramdan (voluntary labor), and their role in community development initiatives.

Course Content:

Unit 1: Introduction and Basic Concepts of NSS   **(8 Hrs.)**
National Service Scheme (NSS) - history, philosophy, and fundamental concepts, aims and objectives, providing clarity on the organization's overarching goals. Symbols of NSS - Emblem, flag, motto, song, and badge; Organizational structure of NSS

Unit 2: NSS Programmes and Activities   **(7 Hrs.)**

Diverse programmes and activities conducted under the aegis of the National Service Scheme (NSS); Significance of commemorating important days recognized by the United Nations, Centre, State Government, and University; Examination of the methodology for adopting villages/slums and conducting surveys; Financial patterns of the NSS scheme

Unit 3: Community Mobilization (**8 Hrs.**)
Dynamics of community mobilization within the framework of the National Service Scheme (NSS); Functioning of community stakeholders; The conceptual lens of communitydevelopment

Unit 4: Volunteerism and Shramdan in the Indian Context: Roles and Motivations withinthe NSS Framework (**7 Hrs.**)
Ethos of volunteerism and shramdan (voluntary labor) within the cultural context of India and the framework of the National Service Scheme (NSS); Motivations and constraints shaping volunteer engagement; Role of NSS volunteers in initiatives such as the Swatch Bharat Abhiyanand Digital India

References:
1. Ministry of Youth Affairs and Sports, Government of India. (2022). National Service Scheme (NSS) Manual.
2. Agarwalla, S. (2021). NSS and Youth Development. Mahaveer Publications
3. Bhattacharya, P. (2024). Stories Of NSS (English Version). Sahityasree.
4. Borah, R. and Borkakoty, B. (2022). NSS in Socioeconomic Development. Unika Prakashan.
5. Wondimu, H., & Admas, G. (2024). The motivation and engagement of student volunteers in volunteerism at the University of Gondar. *Discover Global Society*, *2*(1), 1-16.
6. Saha, A. K. (2002). Extension Education–The Third Dimension Needs and Aspirations of Indian Youth. *Journal of Social Sciences*, *6*(3), 209-214.
7. Mills, S. (2013). "An instruction in good citizenship": scouting and the historical geographies of citizenship education. *Transactions of the Institute of British Geographers*, *38*(1), 120–134. http://www.jstor.org/stable/24582445
8. Mishra, S. K., Sachdev, S., Marwaha, N., & Avasthi, A. (2016). Study of knowledge and attitude among college-going students toward voluntary blood donation from north India. *Journal of blood medicine*, 19-26.
9. Mukherji, B. (2007). Community Development in India. Orient Longmans.
10. History Background of NSS and its Philosophy, Aims and Objectives
11. https://www.osmania.ac.in/NSS%20URL/9.%20%20Historical%20Background%20o f% 20NSS%20and%20its%20Philosophy,%20Aim.pdf
12. In Defence of Nationalism https://www.mkgandhi.org/indiadreams/chap03.htm
13. Unlocking Youth Potential for Nation Building: Strengthening NYKS and NSS
14. https://www.undp.org/india/projects/strenghtening-nyks-and-nss

Course Outcome(s):

1. Students will demonstrate an understanding of the history, philosophy, and objectives of the National Service Scheme (NSS), thereby fostering increased social awareness and patriotism among them.
2. Students will be able to organize and conduct various NSS programmes and activities effectively and through it understand the importance of leadership and team building.
3. Students will develop skills in community mobilization and partnership building.
4. Students will appreciate the importance of volunteerism and shramdan in societal development and thus, be able to understand role of community participation.

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DISASTER MANAGEMENT

5. In our rapidly evolving 21st-century world, challenges emerge in diverse forms, transcending borders and intertwining economic, societal, and environmental realms. These challenges profoundly affect vulnerable communities, magnifying their susceptibility to climate-related shocks and disasters. As we navigate through these complexities, it becomes increasingly evident that aligning strategies with global Sustainable Development Goals (SDGs) across various geographical scales is paramount. This alignment incorporates perspectives of environmental sustainability, climate adaptation, and disaster resilience. In light of these considerations, this course aims to equip students with the knowledge and skills necessary to address and mitigate the impacts of disasters in a holistic manner.

Course Objective(s):

● to provide understanding of the concepts related to disaster

● to highlight the importance and role of disaster management

● to enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

Course Content:

Unit 1: Concepts and Terminologies (8 Hrs.)
Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)

Unit 2: Key concepts of Disaster Management Cycle (7 Hrs.)
Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction

Unit 3: Initiatives at national and international level (8 Hrs.)
Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation; International strategy for disaster reduction and other initiatives

Unit 4: Emergency Management   **(7 Hrs.)**

Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts

Training and Demonstration Workshops (at least two workshops) be organized in association with the NIDM, NDRF, NCDC, Param Military, Fire Brigade, CISF, local administration etc.

Readings

1. Sharma, S.C. (2022), Disaster Management, Khanna Book Publishing.
2. Clements, B. W., (2009): Disasters and Public Health: Planning and Response, Elsevier Inc.
3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human HealthRisk: Reducing Risk, Improving Outcomes, WIT Press, UK.
4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability andMitigation, Rawat Publications, New Delhi.
5. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Carter, N. (1991) Disaster Management: A Disaster Management Handbook. Asian Development Bank, Manila.
8. Govt. of India (2008) Vulnerability Atlas of India. BMTPC, New Delhi.
9. Govt. of India (2011) Disaster Management in India. Ministry of Home Affairs, New Delhi.
10.   Matthews , J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, IanMason.

E-Resources
http://www.ndma.gov.in/en/   http://nidm.gov.in/
https://www.unisdr.org/   http://www.emdat.be
https://www.weather.gov/safety/
https://www.preventionweb.net/risk/vulnerability

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

i.   Articulate the critical role of disaster management in reducing risks and enhancing resilience

ii. Identify and describe key institutional frameworks and processes in disaster management.

iii. Conduct risk assessments and develop disaster management plans for specific scenarios

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SEMESTER-IV

101CC 204/ 102CC 204	Entrepreneurship and Startup Ecosystem	1L:1T:0P	2 Credits

Course Objective(s):
- To understand Entrepreneurship and its types
- To understand that not all ideas can be turned into viable business models and guestimatebusiness potential of an idea
- To understand different type of finances available and financing methods
- To be able to draft business plans on an identified idea
- To understand the nuances of operating a startup – low budget marketing, stabilizing operations, build a team from scratch and scaling the business
- To know what is a Family Business and how is it different from Entrepreneurship

Course Content:

Unit 1: Introduction to Entrepreneurship & Family Business   (4 Hrs.)
- Definition and Concept of entrepreneurship
- Entrepreneur Characteristics
- Classification of Entrepreneurs
- Role of Entrepreneurship in Economic Development –Start-ups
- Knowing the characteristics of Family business with discussion on few Indian cases ofFamily Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

Unit 2: Evaluating Business opportunity   (4 Hrs.)

- Sources of business ideas and opportunity recognition
- Guesstimating the market potential of a business idea
- Feasibility analysis of the idea
- Industry, competition and environment analysis

Unit 3: Building Blocks of starting ventures   (4 Hrs.)

- Low cost Marketing using digital technologies
- Team building from scratch
- Venture Funding
- Establishing the value-chain and managing operations
- Legal aspects like IPR and compliances

Unit 4: Start-up Ecosystem   **(4 Hrs.)**

- Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.
- Know various govt. schemes like Start-up India, Digital India, MSME etc.
- Sources of Venture Funding available in India
- Source of Technology, Intellectual Property management

Text Books (Latest Edition):

1. *Startup India Leaning Program* by Start Up India available at www.startupindia.gov.in
2. Entrepreneurship, Rajeev Roy, Oxford University Press
3. Entrepreneurship: Successfully Launching New Ventures by R. Duane Ireland Bruce R.Barringer, Pearson Publishing
4. Family Business Management by Rajiv Agarwal, Sage Publishing
5. Anish Tiwari (2003), "Mapping the Startup Ecosystem in India", Economic & PoliticalWeekly
6. Ramachandran, K, Indian Family Businesses: Their survival beyond three generations,ISB Working Paper Series

References

Course Outcome(s):
At the end of the course, the student would be able to -
- Understand basic building blocks of creating a venture
- Be able to identify a business opportunity and translate it into a viable business model
- Identify the elements of the Indian entrepreneurship ecosystem and take relevantbenefits from the constituents
- Know the legacy of family businesses and key differentiations from entrepreneurship

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101CC205/ 102CC205	**Computer Networks**	**3L:0T:0P**	**3 Credits**

Course Objectives:

CO1: Understand the fundamental concepts of Computer Networks and their applications.
CO2: Develop problem-solving skills related to network design, implementation, and troubleshooting.
CO3: Implement network protocols and configure network devices.

Prerequisites:
1. Basic Networking Knowledge: Familiarity with basic networking concepts such as IPaddressing and network topologies.
2. Programming Skills: Ability to write basic network programs and scripts in languages suchas Python or C.
3. Operating Systems: Understanding of OS concepts related to networking, such as processmanagement and memory allocation

Course Content:

UNIT-I	**Introduction to Computer Networks**
	Overview of Computer Networks: Definition and Objectives, Applications and ExamplesNetwork Components and Architecture
	Network Models: OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions Comparison between OSI and TCP/IP Models
	Network Topologies: Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology
	Data Transmission: Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex,Full-Duplex, Bandwidth and Latency
	Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions andConfigurations of Each Device. **(12 Hrs.)**
UNIT-II	**Data Link Layer and Networking Protocols**
	Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection,and Error Correction, Flow Control Mechanisms.
	Ethernet: Ethernet Standards and Frame Structure, MAC Addressing and ARP, EthernetSwitching: Basic Concepts and Methods
	Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6Subnetting and CIDR Notation. **(11 Hrs.)**
UNIT-III	**Network Layer and Transport Layer**
	Network Layer: IP Routing: Static vs. Dynamic Routing, Routing Protocols: RIP, OSPF, BGP,Network Address Translation (NAT)
	Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake andConnection Management, Flow Control and Congestion Control in TCP
	Network Security Fundamentals: Threats and Vulnerabilities, Basic Security Mechanisms:Firewalls, VPNs, Encryption **(11 Hrs.)**
UNIT-IV	**Application Layer and Emerging Technologies**
	Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3,IMAP: Protocols and Uses, DNS: Domain Name System and

	Resolution **Network Applications:** Web Browsing, Email Communication, File Transfer, Voice over IP(VoIP) and Streaming. **Emerging Technologies:** Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking **Network Management:** SNMP: Simple Network Management Protocol, Network MonitoringTools and Techniques. **(11 Hrs.)**

Text Books:
1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8thEdition, Pearson, 2021.

Reference Books:
1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-HillEducation, 2012.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6thEdition, Morgan Kaufmann, 2019.
3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna PublishingHouse, 2023.
4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

Web Resources:
1. Cisco Networking Academy - Online Courses and Resources
2. NetworkLessons.com - Tutorials on Various Networking Topics

101LabCC205/ 102LabCC205	Computer Networks	0L:0T:4P	2 Credits

Lab Programs:
1. Configure Basic Network Settings:
    a) IP Address Configuration
    b) Subnet Mask and Gateway Settings
2. Implement Network Protocols:
    a) Write a simple Python script to perform DNS resolution.
    b) Implement a basic HTTP client-server application.
3. Network Simulation:
    a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate networktopologies.
    b) Configure routers and switches in a simulated environment.
4. Performance Measurement:
    a) Measure network performance using tools like `ping`, `traceroute`, and `iperf`.
    b) Analyze network traffic using Wireshark.
5. Set Up a Simple Web Server:
   a) Deploy a basic web server and configure HTTP/HTTPS access.
6. Network Security Lab:
   a) Implement basic firewall rules and VPN configurations.
   b) Perform vulnerability scanning and analyze results.
7. Network Troubleshooting:
   a) Diagnose and resolve common network issues.
   b) Use troubleshooting commands and techniques to fix connectivity problems.

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101CC206/ 102CC206	**Design and Analysis of Algorithm**	**3L:0T:0P**	**3 Credits**

Course Objectives

CO1: This course envisions to impart to students the understanding of basic algorithm designing paradigms.

CO2: This course introduces the basic knowledge on how to analyse an algorithm.

CO3: This course expects to enable a student to synthesize efficient algorithms incommondesign situations and real-life problems.

Prerequisite: Knowledge of Data Structures

Course Content:

UNIT-I	What is an algorithm? Design and performance analysis of algorithms, time complexity, spacecomplexity.
	Asymptotic notations (O, Ω, Θ) to measure growth of a function and application to measurecomplexity of algorithms.
	Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem **(12 Hrs.)**
UNIT-II	The Divide & Conquer Design Technique:
	The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting.
	The Greedy Design Technique:
	The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem. **(11 Hrs.)**
UNIT-III	The Dynamic Programming Design Technique:
	The general concept. Computation of Fibonacci series and Binomial coefficients, all pairshortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.
	Algorithms on Graphs:
	Breadth First Search, Depth First Search, finding connected components, depth first search of adirected graph, topological sorting. **(11Hrs.)**
UNIT-IV	Limitations of Algorithmic Power:
	Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem.
	Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Completeand NP-hard problems. **(11 Hrs.)**

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of ComputerAlgorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson,2012

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis ofComputer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Web Resources

1. https://nptel.ac.in/courses/106101060
2. https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf

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101CC207/ 102CC207	Artificial Intelligence	3L:0T:0P	3 Credits

Prerequisites:
Basic understanding of computer science concepts, including data structures and algorithms.Proficiency in minimum one programming language, such as Python.

Course Content:

UNIT-I	**Introduction to Al** What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the natureof environment, the structure of Agents. Knowledge-Based Agents**:** Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents. **(12 Hrs)**
UNIT-II	**Advanced Search Techniques** Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. **(11 Hrs.)**
UNIT-III	**Logical Reasoning and Uncertainty** Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Introduction to Planning: Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Introduction to Fuzzy logic. **(11 Hrs.)**
UNIT-IV	**Domains and Applications of AI** Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, NaturalLanguage Processing, Deep Neural Networks, and their Applications. Expert Systems: The architecture and role of expert systems. **(11 Hrs.)**

Text Books:
1. M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book PublishingCompany, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, *Artificial Intelligence: A new Synthesis*, Morgan Kaufmann PublishersInc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning 2010.
4. Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning and DeepLearning*, Khanna Book Publishing Company, 2024.

Reference Books:
1. M.C. Trivedi, *Introduction to AI and Machine Learning*, Khanna Book PublishingCompany, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd

edition,Prentice Hall

3. Van Hirtum, A. & Kolski, C. (2020). *Constraint Satisfaction Problems: Algorithms andApplications*. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book PublishingCompany, 2024.

Course Outcomes:

CO1: Understand the characteristics of rational agents, and the environment in which theyoperate, and gain insights about problem-solving agents.

CO2: Gain insights about Uninformed and Heuristic search techniques and apply them tosolve search applications.

CO3: Appreciate the concepts of knowledge representation using Propositional logic andPredicate calculus and apply them for inference/reasoning.

CO4: Obtain insights about Planning and handling uncertainty through probabilistic reasoningand fuzzy sets.

CO5: Obtain a basic understanding of the AI domains and their applications and examine thelegal and ethical issues of AI

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Artificial Intelligence Lab

Prerequisites: Basic understanding of algorithms and data structures (e.g., trees, graphs, lists).Proficiency in Python programming, including libraries like NLTK for NLP tasks.

101LabCC207/ 102LabCC207	Artificial Intelligence	0L:0T:4P	2 Credits

LAB Experiments

The lab experiments may be implemented in Python. Libraries like NLTK, Tensorflow andKeras may be used for Machine learning experiments.

Suggested list of Experiments (not limited to):
1. Demonstrate basic problem-solving using Breadth-First Search on a simple grid.
2. Implement Depth-First Search (DFS) on a small graph.
3. Solve the Water Jug Problem using Breadth First Search (BFS).
4. Implement a Hill Climbing search to find the peak in a numeric dataset.
5. Apply the A* Search algorithm to find the shortest path in a 4x4 grid.
6. Implement the Minimax search algorithm for 2-player games. You may use a game tree with3 plies.
7. Solve the 4 – Queens Problem as a CSP backtracking problem.
8. Use constraint propagation to solve a Magic Square puzzle.
9. Apply optimization techniques to find the maximum value in a list.
10. Represent and evaluate propositional logic expressions.
11. Implement a basic rule-based expert system for weather classification.
12. Implement a basic AI agent with simple decision-making rules.
13. Implement a basic Rule-Based Chatbot.
14. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks fortext content.
    a) Tokenizing
    b) Filtering Stop Words
    c) Stemming
15. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks fortext content.
    a) Part of Speech tagging
    b) Chunking
    c) Named Entity Recognition (NER)

Course outcomes:
   CO1: Apply Uninformed Search Algorithms and Implement Heuristic Search techniquesCO2: Analyze and Solve Constraint Satisfaction Problems
   CO3: Develop Rule-Based Systems
   CO4: Implement and Evaluate Optimization TechniquesCO5: Apply and illustrate the NLP concepts

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101DSE202	Introduction to ML	1L:0T:0P	1 Credits

Prerequisites: Basic knowledge of statistics and probability. Familiarity with fundamental programming concepts and proficiency in Python.

Course Content:

UNIT-I	**Introduction to Machine Learning**
	Introduction: Definition, History and Application of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Semi Supervised, and Reinforcement Learning. Labeled and Unlabeled Dataset. Supervised Learning Tasks: Regression vs. Classification, Learning Framework: Training, Validation and Testing of ML models. Performance Evaluation Parameters: Confusion matrix, Accuracy, Precision, Recall, F1 Score,and AUC. **(8 Hrs.)**
UNIT-II	**Supervised Learning and Unsupervised Learning**
	Regression: Linear and non-linear Regression, Logistic Regression. *Classification*: Naïve Bayes, K Nearest Neighbors, Decision Trees. Linear model: Introduction to Artificial Neural Networks, Perceptron Learning Algorithm, Single Layer Perceptron, Introduction to Support Vector Machine for linearly separable data. *Clustering*: K-Means, Hierarchical Clustering, DBSCAN, Clustering Validation Measures. *ML Applications:* Ethical Considerations in Machine Learning, Case study and Real-world Applications. **(7 Hrs.)**

Text Books:
1. Rajiv Chopra (2024), Machine Learning and Machine Intelligence, Khanna Publishing House.
2. JeevaJose(2023),IntroductiontoMachineLearning,KhannaPublishingHouse.
3. Mitchell T.(1997).Machine Learning, First Edition, McGraw-Hill.
4. Kalita, J. K., Bhattacharyya, D. K. , & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier.ISBN9780323917780

Reference Books:
1. Flach, P. A. (2012). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge UniversityPress.ISBN:9781107422223,2012.
2. Duda,R.O.,Hart,P.E.,Stork,D(2007).Patternclassification(2Ed),JohnWiley&Sons,ISBN-13: 978-8126511167.
3. Haykin S.(2009). Neural Networks and Learning Machines, Third Edition, PHI Learning.
4. Chollet, F.(2018). Deep Learning with Python. Manning Publications.
5. Bishop, C. M.(2006). Pattern Recognition and Machine Learning. Springer.
6. Good fellow, I., Bengio,Y.,& Courville, A.(2016).Deep Learning. MIT Press.
7. Géron, A. (2017). Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems* (1st ed.). O'Reilly Media.

Course Outcomes

CO1: Define and explain machine learning concepts, types, and basic metrics.

CO2: Implement and apply supervised learning techniques (e.g., KNN, Linear Regression, Logistic Regression).

CO3: Apply unsupervised learning methods (e.g., K Means, Hierarchical Clustering, Association Rules).

CO4: Develop and evaluate simple machine learning models (e.g., Perceptron, single-layer neural networks).

CO5: Analyze and apply appropriate machine learning algorithms depending on the problems with some real-world data.

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101LabDSE202	Introduction to ML	0L:0T:4P	2 Credits

Prerequisites: Understanding of machine learning algorithms and concepts (e.g., classification, clustering, regression). Proficiency in Python programming, with experience using libraries such as NumPy, pandas, Scikit-Learn, NLTK, Matplotlib, and Seaborn.

LAB Experiments

The lab experiments may be implemented in Python using relevant ML libraries, and data sets from Kaggle, public repositories, or generated datasets.

Suggested list of Experiments (not limited to):

1. Implement linear regression on a dataset and visualize the regression line.
2. Implement logistic regression on a binary classification data set and plot the decision boundary.
3. Implement and evaluate the performance of Decision tree ID3/ Cart classifier for any given dataset.
4. Implement and evaluate the performance of the Naïve Bayes Classifier on a given dataset.
5. Build and evaluator and om forest classifier using a numerical dataset.
6. Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary.
7. Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.
8. Implement hierarchical clustering on a dataset.
9. Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.
10. Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.
11. Build a single layer perceptron model to classify AND, OR, and XOR problems (may use TensorFlow / Keras) and visualize their decision boundaries. Also evaluate its performance.
12. Demonstrate the concept of boosting using the Ada Boost algorithm.

Course Outcomes

CO1: Implement and evaluate supervised learning techniques, including K-Nearest Neighbors, linear regression, and logistic regression, and measure model performance using accuracy, precision, recall, andF1 score.

CO2: Apply and visualize clustering algorithms such as K-Means, hierarchical clustering, and DBSCAN on datasets. This practical application helps you understand their real-world use.

CO3: Perform dimensionality reduction using Principal Component Analysis (PCA) and interpret the results.

CO4: Develop and assess classification models using random forests, support vector machines, and neural networks.

CO5: Demonstrate ensemble learning concepts through bagging with random forests and boosting with the AdaBoost algorithm.

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102DSE202	Data Visualization	1L:0T:0P	1 Credits

Course Objectives
CO1: Understand the fundamentals of data visualization and its importance.
CO2: Learn about visual perception and its impacton data interpretation.
CO3: Explore the ethical considerations andchallenges in data visualization.
CO4: Study different types of visualizations and their appropriate uses.
CO5: Utilize Power BI to create and customize various types of visualizations.

Prerequisite:
Familiarity with using a computer, including file management and basic software navigation. Basic knowledge of data structures, such as tables and databases. Basic understanding of data analysis concepts and familiarity with datatypes.

Course Content:

UNIT-I	Introduction to Data Visualization
	Definition and importance of data visualization-Role of data visualization in decision making-Types of data (numerical, categorical, temporal, geographical)-Data visualization process (datacollection, exploration, analysis, visualization, interpretation)-Challenges and limitations of data visualization
	Visualization tools: Overview of Visualization Tools (e.g., Excel, Tableau, PowerBI, Python) - Comparing and contrasting features and Use Cases among these tools. **(8 Hrs)**
UNIT-II	Principles of Data Story telling : Narrative and Context-Best Practices for Dashboard Layout and Interactivity
	Designing Effective Visualizations
	Principles of Good Visualization Design - Understanding and Using Color in Visualizations –Importance of Data Modelling in Visualization.
	(9 Hrs.)

TextBooks
1. "Story telling with Data : A Data Visualization Guide for Business Professionals " Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.
2. "The Visual Display of Quantitative Information " by Edward Tufte, Graphics Press USA ; 2nd edition, 2001.

Reference Books
1. "Data Visualization: A Practical Introduction" Kieran Healy, Princeton University Press, 2018.
2. "Analyzing Data with Power BI and Power Pivot for Excel ", Alberto Ferrari and Marco Russo, Microsoft Press; 1st edition, 2017.
3. "Microsoft Power BI Complete Reference", Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Packt Publishing; 1st edition,2018.

Web Resources
1. https://learn.microsoft.com/en-us/power-bi/
2. https://www.storytellingwithdata.com/
3. https://jpsm.umd.edu/sites/jpsm.umd.edu/files/syllabi/Syllabus_Introduction%20to%20Data%20Visualization_Spring%202024.pdf

| 102DSE202 | **Data Visualization LAB** | 0L:0T:4P | **2 Credits** |

Lab Programs for Data Visualization Using Power BI

Introduction to Power BI Interface and Basics
1. Installation and interface overview
2. Exploring the Power BI workspace : Ribbon, panes, and canvas.
3. Importing data from Excel and CSV files.
4. Introduction to multiple data sources
5. Basic report creation : Adding visuals and saving a report.

Data Transformation and Preparation
1. Using Power Query Editor
2. Cleaning data : Removing duplicates, handling missing values.
3. Transforming data : Splitting columns, changing datatypes, renaming columns.
4. Merging and appending queries.
5. Creating custom columns and calculated columns

Data Modeling
1. Creating relationships between tables
2. Identifying and resolving data in consistencies
3. Creating calculated columns and measures

Creating Basic Visualizations
1. Creating various chart types (bar, column, line, pie, area, etc.,)
2. Formatting and customizing visualizations

Publishing and Sharing Reports
1. Publishing a report to Power BI Service.
2. Sharing reports and dashboards with team members.
3. Setting up data refresh schedules and managing permissions.

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101SEC202/ 102SEC202	**Design Thinking and Innovation**	1L:1T:0P	2 Credits

Course Objectives:

Operating under turbulent and uncertain business environment, 'innovation' has become the key driver of organizational success for all companies. Managers are expected to be leading this change by navigating companies into rapid evolution of new products/services and business models.

The primary focus of DTI is to help learners develop creative thinking skills and apply design based approaches/tools for identifying and implementing innovation opportunities into implementable projects. Following a learning-by-doing approach, the objectives of the course are
–
1. Introduce students to design-based thinking approach to solve problems
2. Observe and assimilate unstructured information to well framed solvable problems
3. Introduce student to templates of ideation
4. Understand the importance of prototyping in the innovation journey
5. Implementing innovation projects

Course Content:

Unit 1: Basics of Design Thinking (8 Hrs.)
1. Understand the concept of innovation and its significance in business
2. Understanding creative thinking process and problem solving approaches
3. Know Design Thinking approach and its objective
4. Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.
5. Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc.
6. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement

Unit 2: Learning to Empathize and Define the Problem (7 Hrs.)
1. Know the importance of empathy in innovation process – how can students develop empathy using design tools

2. Observing and assimilating information
3. Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences.
4. What are wicked problems
5. Identifying wicked problems around us and the potential impact of their solutions

Unit 3 : Ideate, Prototype and Implement (8 Hrs.)

1. Know the various templates of ideation like brainstorming, systems thinking
2. Concept of brainstorming – how to reach consensus on wicked problems
3. Mapping customer experience for ideation
4. Know the methods of prototyping, purpose of rapid prototyping.
5. Implementation

Unit 4 : Feedback, Re-Design & Re-Create (7 Hrs.)

1. Feedback loop, focus on User Experience, address ergonomic challenges, user focuseddesign
2. Final concept testing,
3. Final Presentation – Solving Problems through innovative design concepts & creativesolution

Text Books (Latest Edition):

1. E Balaguruswamy (2023), Developing Thinking Skills (The way to Success), KhannaBook Publishing Company
2. Tim Brown, (2008), "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", *Harvard Business Review*
3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing

Reference Book
1. Design Thinking by Nigel Cross, Bloomsbury

Course Outcome(s):
By the end of the course, students will be able to –

● Propose real-time innovative product designs and Choose appropriate frameworks,strategies, techniques during prototype development.

● Know wicked problems and how to frame them in a consensus manner that is agreeable to all stakeholders using appropriate frameworks, strategies, techniques during prototypedevelopment.

● Analyze emotional experience and Inspect emotional expressions to better understandusers while designing innovative products

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