Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-411048

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for
FY B. Tech.
CSE (Data Science)
Pattern 2023- NEP

Vision

Excellence in Data Science to empower the future of technology with holistic development.

Mission

- To impart quality education with contemporary industry needs using emerging Machine Learning & Data Science techniques.
- To cultivate a research-oriented mindset and comprehensive professional skills.
- To equip learners with interdisciplinary skill sets to cater the needs of the industry and society.

Program Outcomes

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first` principles of mathematics, natural sciences and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems:

societal and environmental contexts **PO5.**Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** Apply Data Science techniques to extract valuable insights from real-world data for informed decision-making.
- **PSO b:** Apply machine learning and AI concepts for predictive modeling and intelligent system development.

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Department of CSE (Data Science)

F.Y. B. TECH CSE (Data Science)

SEMESTER I (PATTERN 2023-NEP) AY 2023-24

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/ TW		
BS10232	Calculus	TH	3	1	-	20	20	20	40	25	125	4
BS10233	Environmental Science	TH	2	-	2	20	20	20	40	25	125	3
CD11235	Programming Paradigm Methodology	TH	2	-	2	20	20	20	40	25	125	3
CD11236	Digital Electronics	TH	2	-	2	20	20	20	40	25	125	3
CD11237	Data Storytelling	CE	1	-	2	-	-	-	-	50	50	2
BS11238	Course on Indian Science and Technology	CE	1	1	-	-	-	-	-	50	50	2
BS11239	English for Technical writing	CE	1	1	-	-	-	-	-	50	50	2
BS112310	Yoga and Sports	CC1	-	-	4	-	-	-	-	50	50	2
	Total		**12**	**3**	**12**	**80**	**80**	**80**	**160**	**300**	**700**	**21**

BOS Chairman **Dean Academics** **Director**

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune - 411048

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of CSE (Data Science)

F.Y. B. TECH (Data Science)

SEMESTER II (PATTERN 2023-NEP) AY 2023-24

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	SCE	ISE	ESE	PR/OR/ TW		
BS10231	Linear Algebra	TH	3	1	-	20	20	20	40	25	125	4
BS10234CS	Physics	TH	2	-	2	20	20	20	40	25	125	3
CD12233	Problem Solving and Programming	TH	2	-	2	20	20	20	40	25	125	3
CD12234	Fundamentals of Data Structure & Algorithm	TH	2	-	2	20	20	20	40	25	125	3
CD12235	Fundamentals of Data Science	TH	2	-	2	20	20	20	40	25	125	3
CD12236	Data Visualization	CE	1	-	2	-	-	-	-	50	50	2
ME12237	Maker's Lab	CE	-	-	2	-	-	-	-	25	25	1
BS12238	NSS/Club Activities/Cultural Activities/ Performing Arts	CE	-	-	4	-	-	-	-	50	50	2
Total	**12**		**12**	**1**	**16**	**100**	**100**	**100**	**200**	**250**	**750**	**21**

BOS Chairman **Dean Academics** **Director**

SEMESTER-I

BS10232 - Calculus and Ordinary Differential Equation

Teaching Scheme	Examination Scheme
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 3 Hrs/week	In-Semester Examination (ISE): 20 Marks
Tutorial: 1 hr / week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:

- Basics of derivatives, integration, plane geometry and vector algebra

Course Objectives:

It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful.

Course Outcomes:

After completion of the course, student will be able to

1. Deal with derivative of functions of several variables that are essential in various branches of engineering
2. Apply the knowledge of partial derivatives to find extreme values of the function of several variables, to find gradient & directional derivative, Jacobian, approximate values and to estimate errors.
3. Learn the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems
4. Learn advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions needed in evaluating multiple integrals and their applications.
5. Learn evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces
6. Learn the effective mathematical tools for solutions of first order differential equations that model various physical processes

Content

Unit I: Introduction to programming paradigms

Partial Derivatives of first and higher orders, Euler's Theorem on Homogeneous functions, Partial derivative of Composite functions, Total derivative and Implicit differentiation

Unit II – Applications of Partial Differentiation

Maxima and minima of function of two variables, Lagrange's method of undetermined multipliers, Tangent Plane and Normal to a Surface, Gradient and Directional Derivative, Errors & Approximations, Jacobian

Unit III – Fourier Series

Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Applications to problems in Engineering.

Unit IV– Integral Calculus & Curve Tracing

Reduction formulae, Beta & Gamma functions, Tracing of standard curves.

Unit V – Multiple Integrals and Applications

Double Integration: Double integration in Cartesian & Polar coordinates, Change of order of integration, area bounded by curves

Triple Integration: Triple integral, volume bounded by surfaces.

Unit VI – Differential Equations and Applications

Exact differential equation, Linear differential equation, Equations reducible to linear form, Bernoulli's differential equation, Applications of differential equations.

Text Books:

	1	Higher Engineering Mathematics by B.V.Ramana., Tata McGraw Hill Publisher
	2	Higher Engineering Mathematics by B.S.Grewal, Khanna Publisher.
	3	Higher Engineering Mathematics by H.K.Dass, S.Chand Publication
	4	Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons.

Reference Books:

	1	Advanced Engineering Mathematics by Peter O'Neil, Global Engineering, Publisher.
	2	Textbook of Applied Mathematics (Volume I & II), by P.N.Wartikar & J.N. Wartikar Pune Vidhyarthi Griha Publisher.
	3	Advanced Engineering Mathematics by C.Ray Wylie & L.Barrett, McGraw Hill Publications
	4	Advanced Engineering Mathematics by M.Greenberg, Wiley Publications.

List of Tutorial :

1. Evaluation of partial derivatives, Euler's theorem on homogeneous functions
2. Partial derivative of Composite Function, Total Derivative.
3. Maxima and minima of functions of two variables, Lagrange's methods of undetermined multipliers
4. Gradient & Directional Derivative, Errors & Approximations, Jacobian.
5. Full range Fourier series
6. Half range Fourier series & Harmonic analysis
7. Reduction formulae, Gamma function, Beta function
8. Tracing of cartesian and polar curves

9. Double Integration and area
10. Triple Integration and volume
11. Home Assignment on solution of differential equations
12. Home Assignment on applications of differential equations

BS10233 - Environmental Science

Teaching Scheme	Examination Scheme
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 3 Hrs/week	In-Semester Examination (ISE): 20 Marks
Tutorial: 1 hr / week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:

10 + 2 Syllabus

Course Objectives:

To understand the different aspects of environmental science and management.

Course Outcomes:

Upon completion of the course, students will be able to

1.	Explain Conventional and Non-conventional Energy Resources, with respect to their advantages, disadvantages along with Principal, Construction, and Working of different power plants.
2.	Explain Air, Water, Land and Noise Pollution, suggest remedial measures and calculate particulates and gaseous pollutants in air.
3.	Explain water and waste water management, and compute hardness, alkalinity, BOD, COD and total carbon contents.
4.	Explain the Municipal and Industrial Wastes management along with its sustainability.
5	Use PBL/Seminars as a tool for reinforcing learning of concepts in Environmental Science
6	Learn the effective mathematical tools for solutions of first order differential equations that model various physical processes

Unit I: Multidisciplinary Nature of Environmental Studies and Resources

1. **Environmental Studies:** Definition, Scope, and Importance.
2. **Conventional and Non-conventional Energy Resources:** Conventional and Non-conventional Energy Resources, their Advantages, Disadvantages, and Impact on Environment.
3. **Principal, Construction, Working** of Thermal Power Plant, Hydroelectric Power Plant, Solar Power Plant, Wind Power Plant, Tidal Power Plant.

Unit II – Environmental Pollution

1. **Air Pollution:** Sources, Causes, Effects and Remedial Measures to control Air Pollution, Numerical on measurement of air pollutants for particulates and gaseous pollutants, Discussion on any one case study.
2. Water Pollution: Sources, Causes, Effects and Remedial Measures to control Water Pollution, Discussion on any one case study.
3. **Land Pollution:** Sources, Causes, Effects and Remedial Measures to control Land Pollution, Discussion on any one case study.

4. **Noise Pollution:** Sources, Causes, Effects and Remedial Measures to control Noise Pollution. Discussion on any one case study.

Unit III – Water and Waste Water Management

1 **Introduction:** Water Resources, Impurities in water, Disadvantages of impure water Analysis of water – physical, chemical (hardness, alkalinity and their numerical) and biological (BOD, COD, total carbon contents – Numerical),
2 **Softening of Water:** Zeolite process, Demineralization by ion exchangers, Numerical, Desalination methods - Reverse osmosis & Electro dialysis.
3 **Municipal water treatment:** Specifications for drinking water (IS 10500: 2012)
4 **Wastewater:** Sources, Necessity of treatment, Primary, Secondary, Tertiary Treatment of waste water

Unit IV– Solid and Industrial Waste and Management and Sustainability

1. **Introduction:** Sources, Classification, Environmental impact
2. **Municipal Waste Management:** collection and disposal
3. **Industrial Waste Management:** Biomedical waste, E- waste and Management
4. **Sustainability:** Introduction, Importance, Sustainability related to Environmental Parameters, Green computing and sustainable data centre, Importance of E- vehicle

Laboratory work:

A) List of experiments (Any 6 out of the following experiments)

1 (A)Preparation of chemical solutions and chemical safety and disposal
(B) Determination of error and error analysis
2 Proximate analysis of coal with determination of calorific value.
3 Estimation of temporary & permanent hardness of water sample by EDTA method.
4 Determination of alkalinity of water sample/to determine the acidity of the given sample of water.
5 To determine the quantity of iron present in the given sample of water by spectrophotometer / colorimeter.
6 Analysis of given soil sample with respect to pH and calcium carbonate content.
7 Field work - visit to a local area to document any one environmental issue and management system.
8 To determine physical parameters of water sample such as turbidity, pH, and conductance - virtual lab experiment
9 To determine chemical oxygen demand of water sample - virtual lab experiment
10 To determine pH and specific conductivity of soil sample - virtual lab experiment

B) PBL/Seminar:

Students will select a relevant topic for seminar/project from Environmental Science and will be evaluated based on presentation

Textbooks:

1 Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi
2 R.K. Rajput, Power Plant Engineering, Laxmi Publications New Delhi
3 S.K. Garg, Environmental Engineering (Vol. II), Sewage Disposal and Air Pollution, Khanna Publishers
4 Peavy, Rowe and Tchobanoglous, Environmental Engineering, Tata McGraw-Hill Book Company

Reference Books:

1. E.I. Wakil, Power Plant Engineering, McGraw Hill Publications, New Delhi
2. P.K. Nag, Power Plant Engineering, McGraw Hill Publications, New Delhi
3. Metcalf Eddy, Wastewater Engineering, Treatment and Reuse,
4. McGraw Hill Education Mahua Basu, Fundamentals of Environmental studies,Cambridge publication
5. S M Khopkar, Environmental pollution analysis, New age publication\
6. C S Rao, Environmental pollution control Engineering, New age publication
7. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, Vogel's Text book of Quantitative Chemical Analysis, Pearson Education Ltd.
8. Dr. G.Vijaya Pratap, Dr. Manasi Ghamande, Dr Prashant Pangrikar, De. Balaji Rupnar A Text Book of Environmental Pollution and Management ,R .K Publication
9. Dr .Surendrakumar Yadav, Dr. T. Arunkumar, Dr. Khushal Pathade ,Dr .Manasi Vyankatesh Ghamande A Text Book of Environmental Engineering and Sustainable Development, R.K. Publications
10. Dr. Maaz Allah Khan, Dr. Droupti Yadav, Dr. Pratima V. Damre, Dr .Manasi Vyankatesh Ghamande A Text Book of Water and Waste Water Engineering, R.K. Publications

CD11235: Programming Paradigm Methodology

Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 2 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:	
•	Fundamental of Computers

Course Objectives:	
•	To understand the concepts of principles of programming paradigm
•	To learn the concepts of problem solving and decisions controls statements
•	To learn the concepts of programming using functions
•	To learn the concepts of object oriented programming

Course Outcomes:	
	After completion of the course, student will be able to
1.	Extrapolate the concept programming paradigm methodology
2.	Demonstrate the ability to problem solving using decision controls
3.	Understand concepts of programming using functions, modules, inbuilt libraries and packages
4.	Understand concepts of object oriented programming

Unit I:	**Introduction to programming paradigms**

Introduction to programming paradigms: Imperative, Declarative, Alternative, Types of programming: procedural, object oriented, functional, and logic & rule based, Role of programming languages, Programming paradigms for high level languages, Use of programming paradigms, Characteristics of good programming languages.

Case Studies: Implementation of basic concepts using any programming language

Unit II:	**Decision Control Statements**

Data Types, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops. Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, Strings formatting operator, built in string methods and functions.

Case Studies: Implementation of basic concepts of decision control statements

Unit III:	**Functions and Modules**

Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python: Pandas, Numpy, Matplotlib, Introduction to standard library modules. **Case Studies: Implementation of functions and modules programming using standard examples.**		
Unit IV:	**Object Oriented Programming**	
Features of Object oriented programming- classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. Classes and Objects: classes and objects, class method and self object, class variables and object variables, public and private members, class methods. **Case Studies: Implementation of Object Oriented Programming using standard examples**		
Text Books:		
	1	T. W. Pratt, M. V. Zelkowitz, "Programming Languages Design and Implementation, 4th Ed, PHI, ISBN 81-203-2035-2.
	2	Sebesta R., "Concepts of Programming Languages", 4th Edition, Pearson Education, ISBN81-7808-161-X.
	3	Allen B Downey, ―Think PYTHON‖, O'Rielly, ISBN: 13:978-93-5023-863-9, 4th Indian Reprint 2015
	4	Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
Reference Books:		
	1	Carlo Ghezzi, Mehdi Jazayeri, ―Programming Language Concepts‖,3rd Ed, Wiley Publication ISBN : 978-81-265-1861-6
	2	Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
Online Resources:		
	1	https://nptel.ac.in/courses/106/102/106102067/
	2	https://nptel.ac.in/courses/115104095

CD11236: Digital Electronics

Teaching Scheme	Examination Scheme
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 3 Hrs/week	In-Semester Examination (ISE): 20 Marks
Tutorial: 1 hr / week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:

- Discrete Mathematics

Course Objectives:

1. To understand basic digital circuit design techniques
2. To study the implementation of digital circuits using combinational logic.
3. To study the implementation of digital circuits using sequential logic.
4. To understand basics of Logic Families and IOT circuit boards in development

Course Outcomes:

After completion of the course, student will be able to

- Simplify Boolean algebraic expressions for designing digital circuits using K- Maps. (Analyzing)
- Apply digital concepts in designing combinational circuits. (Applying)
- Apply digital concepts in designing sequential circuits. (Applying)
- Design and implementation of Mini digital circuit applications. (Applying)

Unit I: Number System and Logic Minimization Techniques

Number System: Introduction, Binary number System, Sign-Magnitude representation, One's and Two's complement representation, Binary arithmetic, 2's complement arithmetic, Octal number System, Hexadecimal number System, Basic theorems, and properties.

Logic minimization: Representation of truth-table, Sum of Product (SOP) form, Product of Sum (POS) form, Simplification of logical functions, Minimization of SOP and POS forms using K-Maps up to 4 variables.

Unit II – Combinational Logic

Design of Combinational Logic: Code converter - BCD, Excess-3, Gray code, Binary Code. Half-Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Multiplexers (MUX): MUX (IC 74153, 74151), MUX tree, Demultiplexers (DEMUX)- Decoder. (IC 74138, IC 74154). DMUX Tree, Implementation of SOP and POS using MUX, DMUX, Comparators, 4-bit Magnitude Comparator

Unit III – Sequential Logic

Flip- flop: SR, JK, D, T; Preset & Clear, Master and Slave Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flip Flop.

Registers: Buffer register, shift register (SISO, SIPO, PISO& PIPO), Applications of shift registers.

Counters: Asynchronous counter. Synchronous counter, ring counters, Johnson Counter, Modulus of the counter

Unit IV– Memory

Introduction to Memory Architecture, Memory hierarchy, Types of Memories (RAM, ROM,EPROM,EEPROM), Data Read/ Write process, Static and Dynamic memory, Role of Cache memory, Virtual Memory		
Text Books:		
	1	R. P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, 2003,ISBN0 – 07 – 049492 – 4.
	2	M. Morris Mano, Michael D. Ciletti (2008), Digital Design, 4th edition, Pearson Education Inc, India..
Reference Books:		
	1	John Yarbrough, "Digital Logic applications and Design" Thomson.
	2	Flyod "Digital Principles", Pearson Education
	3	Malvino, D.Leach "Digital Principles and Applications", 5th edition, Tata Mc-Graw Hill.
List of Assignment :		
1. Realize Full Adder and Subtractor using a) Basic Gates and b) Universal Gates.		
2. Design and implement Code Converters-Binary to Gray and BCD to Excess-3.		
3. Design and implement Mux and Demux using IC 74153/74154		
4. Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).		
5. Design of Ripple Counter using JK-Flip Flops.		
6. Design 3 bit Synchronous Up/Down Counter using JK-Flip Flop.		
PBL: PBL on topics from the syllabus for all the students.		

CD11237: Data Storytelling

Teaching Scheme	Examination Scheme
Credits: 2	Continuous Internal Evaluation (CIE):NA
Lectures: 1 Hrs/week	In-Semester Examination (ISE):NA
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): NA
	End Semester Examination (ESE): NA
	TW: 50 Marks

Prerequisites:

- Familiarity with structured data

Course Objectives:

- To enable the students to get acquainted with the context of the data
- To enable students how to effectively communicate insights from data
- To develop proficiency in creating compelling narratives & insights to story using data

Course Outcomes:

After completion of the course, student will be able to

1. Gain knowledge and understand the data analysis with context of the data
2. Effectively communicate insights from data
3. Create insights and narratives using data for target audience

Unit I:	Communicating with data	3 Hrs

Importance of data storytelling in data science and engineering, Importance and relevance of data storytelling in various industries, Data Acquisition and communicating with data, Understanding data syntax and semantics, Components of a data story, Exploring real-world examples of effective data storytelling.

Unit II:	Data Storytelling and Visualization	3 Hrs

Basics of data types, sources, and formats, Importance of visuals used to communicate data, Right Graph for Right Data, Principles of effective data visualization: clarity, accuracy, and simplicity, Introduction to data visualization tools (e.g., Matplotlib, Seaborn)

Unit III:	Constructing Compelling Data Narratives	3 Hrs

Understanding the art of storytelling and its core elements, Crafting a narrative arc for data storytelling: introduction, conflict, resolution, Identifying key insights and takeaways from data analysis, Ethical considerations in crafting narratives and data representation.

Unit IV:	Communicating Data	3 Hrs

Analysing target audiences: technical vs. non-technical, stakeholders, etc., Tailoring data stories for different audience groups, Designing visualizations that cater to specific stakeholder needs, Incorporating interactivity and engagement in data storytelling.

Text Books:

	1	**Storytelling with Data: A Data Visualization Guide for Business Professionals** by Cole Nussbaumer Knaflic
	2	**Data Visualization Made Simple** by Kristen Sosulski

Reference Books:

	1	**Effective Data Storytelling: How to Drive Change with Data, Narrative and**

		Visuals, Brent Dykes, Wiley
	2	**Data Story: Explain Data and Inspire Action Through Story**, Nancy Duarte.

List of Assignments:	
1	**Data Generation for the Review of the Restaurants -** Your task is to initiate the review of restaurants in your city. Decide the factors to perform this review and generate the required data.
2	**Storytelling from Data -** PFA data generated for the specific objective. You have to study the data attached in given sheet, analyse it and prepare the story in the form of presentation template which is already shared with you. Try to focus on the objectives and business intelligence.
3	**Right Graph for Right Data -** Prepare a presentation to demonstrate Lab "Right Graph for Right Data". Take appropriate case studies to explain with significance (Any 5)
4	**Story from Data -** Prepare a presentation to generate the story from given employee data set.
5	**Data Pre-processing -** Consider any sample dataset and analyze it for the purpose of processing and analytics. Apply preprocessing on it which include removal of NULL values, missing values etc. and present this assignment in the group.
6	**Study & Explore Tool -** Download and install RapidMiner studio - an enterprise-ready data science platform. Visualize and explore Data and Prepare data for Analysis.

BS11238 Indian Science and Technology	
Teaching Scheme	**Examination Scheme**
Credits: 2	Continuous Internal Evaluation (CIE):NA
Lectures: 1 Hrs/week	In-Semester Examination (ISE):NA
Practical:	Skills & Competency Exam (SCE): NA
Tutorial (T): 1 hrs./week	End Semester Examination (ESE): NA
	TW: 50 Marks

Prerequisites:

- Nil

Course Objectives:

- Development of a holistic perspective about Indian science and technology

Course Outcomes:

After completion of the course, student will be able to

1. Understand the modern technological trends through Indian scientific and technological philosophy
2. Understand the development of Mathematics and water management systems in India

Unit I: Fundamentals

An overview of Indian contributions to technology
Technological Innovations

Unit II: Mathematics

An overview of the Development of Mathematics in India
Aryabhatta (discovery of zero)
Weaving Mathematics into Beautiful Poetry- Bhaskaracarya.
The Evolution of Sine Function in India
The Discovery of Calculus by Astronomers
Concept of proof in Indian mathematics

Unit III: Water Management

Overview
Harappan and Traditional Water Management System of Gujarat
Historical Sites- Sringeverpur, South Indian Water Management System, WesternGhats Cave- Kanheri etc.
Medieval Period
Involvement of peoples in Water Management

Text Books:

1. R.M. Pujari, Pradeep Kolhe, N. R. Kumar, 'Pride of India: A Glimpse into India's Scientific Heritage', Samskrita Bharati Publication.
2. 'Indian Contribution to science', compiled by Vijnana Bharati.
3. 'Knowledge traditions and practices of India',Kapil Kapoor, Michel Danino, CBSE, India.

Reference Books:

1. Dr. Subhash Kak , Computation in Ancient India,Mount, Meru Publishing (2016)

2. Dharampal, Indian Science and Technology in the Eighteenth Century, Academy of Gandhian Studies, Hyderabad, 1971, republ. Other India Bookstore, Goa, 2000
3. Robert Kanigel, The Man Who Knew Infinity: A Life of the Genius Ramanujan, Abacus, London, 1999
4. Alok Kumar, Sciences of the Ancient Hindus: Unlocking Nature in the Pursuit of Salvation, CreateSpace Independent Publishing, 2014
5. B.V. Subbarayappa, Science in India: A Historical Perspective, Rupa, New Delhi, 2013
6. S. Balachandra Rao, Indian Mathematics and Astronomy: Some Landmarks, Jnana Deep Publications, Bangalore, 3rd edn, 2004
7. S. Balachandra Rao, Vedic Mathematics and Science In Vedas, Navakarnataka Publications, Bengaluru, 2019
8. Bibhutibhushan Datta, Ancient Hindu Geometry: The Science of the Śulba, 1932, repr. Cosmo Publications, New Delhi, 1993
9. Bibhutibhushan Datta & Avadhesh Narayan Singh, History of Hindu Mathematics, 1935, repr. Bharatiya Kala Prakashan, Delhi, 2004
10. George Gheverghese Joseph, The Crest of the Peacock, Penguin Books, London & New Delhi, 2000
11. J. McKim Malville & Lalit M. Gujral, Ancient Cities, Sacred Skies: Cosmic Geometries and City Planning in Ancient India, IGNCA & Aryan Books International, New Delhi, 2000).
12. Clemency Montelle, Chasing Shadows: Mathematics, Astronomy and the Early History of Eclipse Reckoning, Johns Hopkins University Press, 2011
13. Anisha Shekhar Mukherji, Jantar Mantar: Maharaja Sawai Jai Singh's Observatory in Delhi, AMBI Knowledge Resources, New Delhi, 2010
14. Thanu Padmanabhan, (ed.), Astronomy in India: A Historical Perspective, Indian National Science Academy, New Delhi & Springer (India), 2010
15. Acharya Prafulla Chandra Ray, A History of Hindu Chemistry, 1902, republ., Shaibya Prakashan Bibhag, centenary edition, Kolkata, 2002
16. R. Balasubramaniam, Delhi Iron Pillar: New Insights, Indian Institute of Advance Study, Shimla & Aryan Books International, New Delhi, 2002
17. R. Balasubramaniam, Marvels of Indian Iron through the Ages, Rupa & Infinity Foundation, New Delhi, 2008
18. Anil Agarwal & Sunita Narain, (eds), Dying Wisdom: Rise, Fall and Potential of India's Traditional Water-Harvesting Systems, Centre for Science and Environment, New Delhi, 1997

List of Tutorial:

1. Practice session to discuss-Contribution and innovation of Indian Science and Technology
2. Practice session to discuss - The Development of Mathematics in India
3. Practice session to discuss -The Evolution of Sine Function in India
4. Practice session to discuss - Harappan and Traditional Water Management System of Gujarat
5. Practice session to discuss-Historical Sites- Sringeverpur, South Indian Water Management System, Western-Ghats Cave- Kanheri etc
6. Practice session to discuss – Basic concept of Ayuraveda
7. Practice session to discuss- Forest Management and Urban Planning

8. Practice session to discuss - Ancient ecological and environmental aspects of Tank, Lakes,& Step wells
9. Practice session to discuss- Development of Trading Techniques
10. Poster presentation on any one of the above topics

BS11239 English for Technical Writing	
Teaching Scheme	**Examination Scheme**
Credits: 2	Continuous Internal Evaluation (CIE):NA
Lectures: 1 Hrs/week	In-Semester Examination (ISE):NA
Practical:	Skills & Competency Exam (SCE): NA
Tutorial (T): 1 hrs./week	End Semester Examination (ESE): NA
	TW: 50 Marks

Prerequisites:

- Nil

Course Objectives:

1. Improve grasp of English grammar and punctuation rules
   Learn to write precise and concise English text
2. Learn to write reader-friendly text, using rules of organizing a document
3. Apply techniques of writing skills in technical writing, through real life Examples.

Course Outcomes:

After completion of the course, student will be able to

1. Have clarity and coherence in English
2. Produce concise and precise English text
3. Write reader-friendly well organized text in English
4. Write effective reader-friendly technical documents in English of high-quality

Unit I:	**English Language Basics**	**(6 hrs)**

English grammar essentials (Parts-of-speech, tense, active, passive, article), use of punctuation, confusing words-Homophones

Unit II –	**Precise and Concise Writing**	**(6 hrs)**

Logically organizing your thoughts, one idea per sentence/paragraph, avoiding repetition and being specific Using active voice, and strong verbs Using simple plain language, reducing adjectives and adverbs, avoiding unnecessary words Rewriting in smaller number of words/sentences Precise writing through meticulous editing, proofreading, Writing abstracts and conclusions

Unit III:	**Organizing the Written Document**	**(4 hrs)**

Logical organization of text using headings, subheadings, and bullet points. Writing indexes, and table of content, chapters, paragraphs, references
Structuring of formal and informal letters, technical reports and technical presentations

Unit IV:	**Technical Writing**	**(8 hrs)**

Introduction to technical writing, audience analysis and effectiveness, defining purpose of document Writing emails, minutes of meeting, user manuals/guides, FAQs , statement of purpose (SOP), reports, research papers and thesis

Text Books /References Book :

1. English Grammar, Wren and Martin
2. Developing Communication Skills, Krishna Mohan, Meera Banerji, Second Edition, ISBN 10 : 0230-63843-0, ISBN 13: 978-0230-63843-3
3. Technical Communication for Engineers, ShaliniVerma ISBN : 978-93259-9018-0

4. Effective Technical Communication, M Ashraf Rizvi, ISBN-13: 978-0-07-059952-9, ISBN-10: 0- 07-059952-1

Sample List of assignments

1. Edit and proofread the provided technical document, identifying and correcting errors in grammar and punctuation.
2. Write and narrate an article of your choice (like - inventions or discoveries made by any scientist, etc). Note the mistakes you made in grammar, before the final version.
3. Rewrite the assignment in (2) with reduced number of sentences, words, but including all ideas written in the previous assignment. Note the percentage of reduction possible.
4. Write an abstract and conclusion for the given technical document.
5. Read a given unformatted document and organize it into chapters, paragraphs and sub topics. Give necessary heading where required.
6. Write an email to a faculty requesting to work under them as research interns, ensuring clarity, proper etiquette, and concise communication.
7. Prepare a User Manual for a select product. Make it easy to read and informative.
8. Write a precise and accurate technical description of an engineering component, system, or process, focusing on clarity and attention to detail.
9. Prepare a report that identifies and analyzes an engineering problem, proposes potential solutions, and recommends the best course of action

BS112310 Yoga and Sports	
Teaching Scheme	**Examination Scheme**
Credits: 2	Continuous Internal Evaluation (CIE):NA
Lectures:	In-Semester Examination (ISE):NA
Practical: 4 hrs/Week	Skills & Competency Exam (SCE): NA
Tutorial (T):	End Semester Examination (ESE): NA
	TW: 50 Marks

Prerequisites:

- Nil

Course Objectives:

1. To motivate the students for higher education in Yogasana & Sports
2. To motivate the students for higher education in Yogasana / Pranayam and Kriya
3. Relate the fundamental principles of Yoga & sports to applications.
4. To developed Physical & mental fitness, remove stress, frustration and take some ethical knowledge about Yoga and Sports activities.
5. To motivate the students for higher education in Yogvidya & To acquire subject knowledge of Yogvidya
6. To developed skills of game and yogasana pranayama and kriy

Course Outcomes:

After completion of the course, student will be able to

1. Explain the Yoga & Sports ethics as an Indian culture.
2. Explain the basic concept of Physical, Mental fitness and Social awareness or responsibilities.
3. Explain the team work, Yogic Science, the effect on our Mind & Body. And he effect of our lifestyle.
4. Explain the practical of asana like back bending. Front bending, twisting, standing, balancing etc.
5. Explain and practice of Spiritual asana & physical fineness related asana, Pranayama, kriya etc.
6. Check Performance as per practice base Sports Games and yogasana, pranayama and kriya.
7. Well understanding of sports games, yoga ethics as a physical fitness, mental fitness, recreation and refresh of mind and body, as well as healthy lifestyle in daily routine.

Unit I:	**Introduction of Sports Games Yogasana**	**(4 hrs)**

The Basic Exercises, game wise different Rhythmic Exercises, various sports events Introduction & playing methods. Rule regulation of overall events. Athletics events training introduction and practice. Introduction of Yogashastra, Loosening Exercises, Suryanamaskar and its practice in same reputations. Practice of basic and simple healthy asanas.

Unit II –		**(4 hrs)**

Practice session for Outdoor Games, event wise practice and team game organized on the spot. Game wise practice as per student's interest.
Standing Asana Practice & method of practice as well as time , steps and other precautions'
Event wise Measurement and team selection process and practice for recreation and teamwork building

Unit III:	**Various types of Asana, pranayama and sports practice cum Introduction**	**(4 hrs)**

Selected simple types Sitting asana Practice ,Pro down and laydown position practice, twisting asana and pranayama practice Selected basic indoor and outdoor sports events (team event individual events) measurement practice and game practice for physical fitness.		
Unit IV:	**Yoga and sports Practice and matches for etch other**	**(4 hrs)**
All the sports games practice as per the rule as well as yoga practice as per the previous learning based revision. Finalize the best for revision and as per the importance of physical fitness awareness and selected yogic practice like asana pranayama and kriya for spiritual base, physical and mental wellness base as per capacity.		

Text Books /References Book :

1. Athletic Track and court marking Handbook of Games & Sports – Rajesh Agola.
2. Asana, Pranayama & Kriyas by Swami satyanand Swami.Munger.
3. Sports Game and its rule, regulation.
4. Yogic prakriyanche margdarshan – Dr.M.L.Gharote - (The Lonavala Yoga Research Institute,Lonavala)
5. Yogabhyas Ek Sukhi Jivan – Dr.Shripad Jarde (Chandrama Prakashan,Kolhapur)
6. Patanjal Yogsutra Ek Abhyas – Anand Rishi (Rajhans Prakashan,Pune)
7. Yog Ani Arogya – Dr.R.R.Waman (Tilak Maharashtra University,Pune)
8. Textbook of Yoga – Dr.Limbaji Pratale & Dr.Namdev Phatangare.

SEMESTER-II

BS10231 - Linear Algebra	
Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 3 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 1 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:	
•	Basics of derivatives, integration, plane geometry and vector algebra

Course Objectives:	
•	It aims to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students that would be essential for their disciplines.

Course Outcomes:	
Upon completion of course, students will be able to	
1.	Set up, solve and interpret linear systems.
2.	Acquire the knowledge of vector spaces.
3.	Demonstrate linear transformations geometrically.
4.	Apply knowledge of inner product spaces to compute length of a vector, angle, distance between two vectors, to compute orthogonal basis using Gram-Schmidt process.
5	Compute & apply the knowledge of eigenvalues & eigenvectors in various fields of Engineering.
6	Analyze transformations and perform contour integration of complex functions required in Image processing, Digital filters and Computer graphics.

Unit I:	**System of Linear Equations**
Rank of matrix, Elementary Matrices, System of linear equations, Gauss Jordan Elimination, Applications of System of Linear equations.	

Unit II:	**Vector Spaces**
Vector space, subspace, Linear combination, Spanning set, Linear Dependence & Independence of vectors, Basis & dimension of a vector space, Row space, Column Space & null space of a matrix.	

Unit III:	**Linear Transformations**
Introduction to linear transformations, Matrix of a Linear Transformation, Rank and Nullity of Linear Transformations, Orthogonal Transformation, Geometric applications of Linear transformations.	

Unit IV:	**Inner product spaces**
Inner product spaces, Orthogonality, Orthogonal Complement, Gram-Schmidt process of orthogonalization, Applications to least sqaure fitting to data.	

Unit V – Eigen Values and Eigen Vectors

Eigen Values and Eigen Vectors of a matrix, Algebraic and geometric multiplicity, Cayley-Hamilton Theorem, Diagonalization of a matrix, Introduction to Quadratic forms, Definiteness of quadratic form, Sylvester's Criterion, Applications of quadratic forms.

Unit VI	**Complex Variables**

Functions of Complex Variables, Analytic Functions, Miline Thompson's Method, Cauchy-Riemann Equations, Harmonic Functions, Contour Integral, Cauchy's Integral formula.

Text Books:

1. Elementary Linear Algebra by Howard Anton & Chris Rorres, John Wiley & sons.
2. Linear Algebra and its Applications by David C. Lay, Pearson.
3. Linear Algebra and its applications (4th edition) by Gilbert Strang, Cengage Learning.
4. 4. Advanced Engineering Mathematics, by Erwin Kreyszig, John Wiley & Sons.

Reference Books:

1. Schaum's outlines of Linear Algebra (6th edition) by Seymour Lipschutz, Marc Lipson,
2. McGraw-Hill Education (India) Private Limited, New Delhi.
3. Linear Algebra: A Modern Introduction (4th Edition) by David Poole, Linear Cengage Learning
4. Linear Algebra: An Introduction by Ron Larson and David C. Falvo, Cengage Learning
5. 4. Higher Engineering Mathematics.by B. V. Ramana., Tata McGraw Hill Publisher

List of Assignment

1. Problems on Rank of matrix, Elementary Matrices
2. Problems on system of linear equations, Gauss-Jordan Elimination & Applications of System of Linear equations.
3. Problems on Vector Space, Subspace.
4. Problems on Linear Dependence, Independence, Basis and dimension of a vector space.
5. Problems on Linear transformations, Matrix of Linear Transformation, properties of a linear transformation
6. Problems on Rank -Nullity Theorem, Basis and dimensions of Kernel and Image of linear Transformation
7. Problems on Inner product Spaces, angle between two vectors & orthogonality, Gram Schmidt Process.
8. Orthogonal Transformation, Geometric properties of linear operators
9. Eigen Values and Eigen Vectors of a matrix
10. Diagonalization of a matrix, Orthogonal Diagonalization & quadratic forms
11. Assignment on Analytic Functions, Harmonic Conjugate and Miline Thomson's Method
12. Assignment on Cauchy's Integral formula

BS10234CS – Physics – CSE(Data Science)	
Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 2 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Course Objectives:

1. To teach fundamental principles of Physics relevant to circuit branches of Engineering.
2. Relate the fundamental principles of Physics to laboratory experiments.
3. Relate the fundamental principles of Physics to applications.

Course Outcomes:

1. After completing this course learners will be able
2. Explain basics of Semiconductor Physics and use them in understanding of working of diodes
3. Explain the basics of optical fibres and their applications in telecommunication
4. Explain the Physics of select sensors and their applications
5. Explain the basics of Quantum Physics and have a preliminary understanding of the basic tenets of Quantum computing.
6. Perform experiments and analyse the data to understand underlying Physics
7. Use Project Based Learning (PBL) as a tool to learn Applied Physics

Unit I:	**Semiconductor Physics**	**[6 Hrs]**

Free electron theory, Fermi-Dirac distribution function, opening of band gap due to internal electron diffraction from lattice, band theory, Density of states, Carrier density in intrinsic semiconductors, position of Fermi energy in intrinsic semiconductor, Carrier density in extrinsic semiconductor, position of Fermi energy in extrinsic semiconductors, p-n junction diode. Charge density, potential and electric around the junction, and band structure of unbiased diode. Barrier potential, Working of p-n junction diode in the forward and reverse bias on the basis band structure. Ideal diode equation

Unit II:	**Optical Fibre**	**[6 hrs]**

Propagation of light through an optical fibre, Numerical Aperture, Dispersion: Intermodal dispersion, concept of multimode step refractive index, multi-mode graded refractive index, single mode optical fibre, Group velocity and Material Dispersion, Attenuation and selection of wavelength for Optical fibre communication application

Unit III:	**Physics of Sensors & Measurements**	**[6 Hrs]**

Hall sensor, accelerometer, temperature sensor, strain gauges, Measurements - Accuracy, Precision, resolution, errors, error propagation, Calibration of sensors, noise, signal to noise ratio

Unit IV:	**Quantum mechanics & Basics of Quantum Computing**	**[6 Hrs]**

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle. Application/s of uncertainty principle. Qubits, Quantum Entanglement, Quantum Computation & Quantum Algorithms.

Text Books:

1. A Text Book of Engineering Physics – M N Avadhanulu and P G Kshirsagar, S Chand Publishing Ltd, New Delhi.
2. Sears and Zemansky's University Physics – Hugh D Young and Roger A Freedman, Pearson Education.
3. A Textbook of Optics – N Subrahmanyam and BrijLal, S Chand Publications
4. A Text Book of Physics and Non-linear Optics by B. B. Laud

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, Wiley Publications.
2. Optics – Ajoy Ghatak, Tata McGraw Hill.
3. Fundamentals of Optics – Jenkins and White, Tata McGraw Hill
4. A course on Experiments with He-Ne Laser – R S Sirohi, New Age International Publishers
5. Introduction to Solid State Physics - C. Kittel, Wiley Publications
6. Principles of Solid State – H V Keer, New Age International
7. Semiconductor Device Fundamentals – R F Pierret, Pearson
8. Physics of Semiconductor Devices – S M Sze and K K N, Wiley
9. Electronic Principles – Albert Malvino and David Bates, McGraw Hill
10. Integrated Electronics J Millman, C Halkias, McGraw Hill
11. Practical Physics (3rd Ed.) G L Squires, Cambridge University Press

List of Assignment (List of experiments (6 out of the following experiments)

1. To determine band gap of a semiconductor from temperature dependence of its electrical resistance.
2. To determine the I-V characteristics and parameters of a Solar cell.
3. To determine the Hall coefficient and number density of charge carriers of a semiconductor
4. Determination of Numerical Aperture (NA) & Attenuation of an Optical Fiber.
5. To calibrate light sensor BPW34 against a Lux meter
6. To determine the temperature using Pt100 and/or semiconductor temperature sensor and calibrate a carbon resistor
7. To study propagation of error for series and parallel resistor combinations.

B) PBL

PBL on topics from the syllabus for all students

CD12233: Problem Solving and Programming	
Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 2 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	PR: 25 Marks

Prerequisites:	
□	Fundamental Knowledge of Computer

Course Objectives:

1. To understand problem solving aspects.
2. To learn problem solving using computers.
3. To analyse a problem and devise an algorithm to solve it.
4. To learn the basics of Python language.
5. To acquaint with data types, input output statements, decision making, looping and functions in Python.
6. To use Python data structures – lists, tuples, dictionaries to represent complex data.

Course Outcomes:

After completion of the course, student will be able to

1. Inculcate and apply various skills in problem solving.
2. Choose most appropriate programming constructs and features to solve problems in diversified domains.
3. Demonstrate Python programming skills for problems that require the writing of well documented programs including use of the logical constructs of the language
4. Devise algorithms, implement, test, debug and execute programs in the Python language.

Unit I:	**Problem Solving using Computer**

Problem Solving: General Problem-Solving Concepts, Problem solving using computers, Problem solving steps.
Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms, algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).
Illustrative problems: Find minimum/maximum in a list, searching, etc.
Programming Languages: Language as a tool, types of languages, the compilation process

Unit II:	**Python Programming: Control Statements and Functions**

Python Basics, Applications of python programming, Python programming environment, Comments,data types and Variables, Precedence of operators, type conversion, Strings: declaration, manipulation, string formatting operator, Built-in String functions.
Conditional Statements**:** if, if-else; **Looping:** for, while, nested loops, the break, continue, pass, **Functions:** Need for functions, Function: definition, call, variable scope and lifetime, the return statement, passing arguments, recursion, Lambda or anonymous function,

Unit III:	**Built-in structures**

List: creating and accessing elements, traversing a List, List operations, Built-in List functions, List comprehension and slicing;
Tuple: Creating and Accessing a tuple, Basic tuples operations, Built-in tuple functions, indexing;
Dictionary:
Creating and Accessing dictionary elements, Updating Dictionary, DeletingElements from Dictionary, Properties of Dictionary keys, Operations, Built-In Dictionary Functions, **Set:** set operations.

Unit IV:	**Multithreading**

Threading in Python:
Creation, Execution of threads using threading module
GUI in Python:
Introduction to GUI building libraries, Widgets: Button, Canvas, Checkbutton, Entry,Frame, Label, Listbox, Menubutton , Menu, Message, Radiobutton, Scale, Scrollbar , Text, LabelFrame
Regular Expression (RE):
Forming Regular expression, Matching, Searching and replacing operations on RE

Text Books:

	1	R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
	2	Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705

Reference Books:

	1	Problem Solving and Programming Concept, Maureen Sprankle,7th Edition, Pearson Publication.
	2	Python Programming: A modular approach, Taneja Sheetal and Kumar Naveen, First edition, Pearson India, 2017, ISBN: 978-9332585348

Online References:

1. https://www.w3schools.com/python/
2. The Joy of Computing using Python - https://nptel.ac.in/courses/106/106/106106182/
3. Programming, Data Structures and Algorithms using Python - https://nptel.ac.in/courses/106/106/106106145/

List of Assignments:

1	A) Write an algorithm and draw a flowchart to log in to Gmail account B) Write an algorithm and draw flowchart to convert given decimal number to binary

2	**Programs to use Control Statements and Functions** Sample List: 1. Program to find maximum of two numbers 2. Program to check if a number is even or odd 3. Program to check if a number is positive, negative or 0 4. Program to find maximum of three numbers 5. Program to check if a year is leap 6 Program to check if a date is valid 6. Program to find the roots of a quadratic equation 7. Write a python program that accepts the length of three sides of a triangle as inputs. The 8. Program should indicate whether or not the triangle is a right-angled triangle using function.
3	**Programs to demonstrate iteration using loop constructs in Python** Sample List: 1. Program to display first n numbers 2. Program to calculate factorial of a numbers 3. Program to display numbers in the revers order 4. 4 Program to check if a number is prime 5. Program to display first n Fibonacci numbers 6. Program to display the first n prime numbers 7. Program to find the maximum and minimum of n numbers 8. Program to find the LCM of two numbers 9. Program to find the GCD of two numbers
4	**Understand modular programming using functions and different ways of passing argumentsto functions, Lambda functions** Sample List: 1. Function to check if a number is even or odd 2. Function to find the maximum of two numbers
5	**Understand and apply concept of recursion** Sample List: 1. 5 Function to Find the Factorial of a Number Using Recursion 2. 5 Function to Find the Sum of the Digits of the Number Recursively
6	**Programs to demonstrate operations on strings in Python** Sample List: 1. Program to display ASCII Value of a Single Character 2. Program to Concatenate Strings Program to Convert a string to uppercase 3. Program to count occurrences of a character in a string 4. Program to count vowels in a string 5. Program to count words in a sentence 6. Program to check is a string is a palindrome 8 Program to replace characters in a string 7. Program to toggle case of characters in a string 8. Program to find first and last occurrence of a character

7	**Programs to demonstrate operations on lists in Python** Sample List: 1. Program to Create and view elements of a list 2. Program to Create and view elements of a tuple 3 Program to access List Index and Values 3. Program to add two Lists 4. Program to check if a List is Empty or Not 5. Program to Find the Largest Number in a List 6. Program to Find the Second Largest Number in a List 7. Program to Put Even and Odd elements in a List into Two Different Lists 8. Program to Merge Two Lists and Sort it 10 Program to Find the Union of two Lists 9. Program to Find the Intersection of Two Lists 10. Program to Create a List of Tuples with the First Element as the Number and Second Element as the Square of the Number 11. Program to Find all Numbers in a Range which are Perfect Squares and Sum of all Digits in the Number is Less than 10 12. Program to Generate Random Numbers from 1 to 20 and Append Them to the List 13. Program to Remove the Duplicate Items from a List
8	**Programs to demonstrate operations on tuples in Python** Sample List: 1. Program to Create a List of Tuples with the First Element as the Number and Second Element as the Square of the Number 2. Program to Find all Numbers in a Range which are Perfect Squares and Sum of all Digits in the Number is Less than 10 3. Program to Generate Random Numbers from 1 to 20 and Append Them to the Lis 4. Program to Remove the Duplicate Items from a List
9	**Dictionary: Set:** Programs to demonstrate operations on dictionary in Python Sample List: 1. Program to create and view a dictionary 2. Program to create and view elements of a set 3. Program to Print values of dictionary 4. Program to print all keys of dictionary 5. Program to insert and delete from dictionary 6. Program to sort (ascending and descending) a dictionary by value 7. Program to concatenate dictionaries to create a new one 8. Program to check whether a given key already exists in a dictionary. 9. Program to merge two Python dictionaries 10. Program to get the maximum and minimum value in a dictionary

10	**Set:** Programs to demonstrate operations on sets in PythonSample List: 1. Program to Add a list of elements to a set 2. Program to Update the first set with items that don't exist in the second set 3. Program to Return a set of elements present in Set A or B, but not both 4. Program to check if two sets have any elements in common. Program to Remove items from set1 that are not common to both set1 and set2
11	1. Write a python program to implement multithreading scenarios. 2. Create a program to take input of your date of birth and output your age

CD12234: Fundamentals to Data Structure & Algorithm

Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 2 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	OR: 25 Marks

Prerequisites:	
	Fundamentals of Programming

Course Objectives:	
	To Understand Concept of Data Structure and its types
	To Understand Array as Data Structure and its Applications
	To Understand Different Searching and Sorting Techniques
	To Understand Linked List as Data Structure and its Applications

Course Outcomes:	
After completion of the course, student will be able to	
1.	Differentiate Data structure and analyze and synthesize time and space complexity of algorithm.
2.	Use the array as Data Structure for problem solving and programming.
3.	Apply Searching and Sorting Technique to solve real time problems.
4.	Use the Linked List as Data Structure for problem solving and programming.

Unit I:	**Introduction to Data Structure**	**[6 Hrs]**

Basic Terms: Data, Information, Knowledge. Data Structure: Definition, Types(Linear vs. Non- Linear, Static vs. Dynamic, Persistent vs. Ephemeral)

Programming Concepts: Variables and its types, Data Types, Abstract Data Type(ADT), conditional structures, Loops, Language Pre-processors like Compiler, Interpreter, Static and Dynamic Memory Allocation, Function, Recursive Function,

Algorithm: Characteristics of good algorithm, Algorithm design tools(Flowchart and Pseudo code)

Analysis of Algorithm: Time Complexity, Space Complexity, Step count method, Asymptotic Notations (Big Oh, Big Omega, Big Theta)

Case Studies: Study and compare different types of Complexities (linear, cubic, logarithmic, etc)

Unit II:	**Array**	**[6 Hrs]**

Department of CSE (Data Science)

Array: Definition, syntax, sequential and random access data structure concept for array.
Types of Array: One Dimensional, Multidimensional. Storage representation (Row Major and Column Major Arrangement), Address Calculation.
Programming: Defining one dimensional and two dimensional array, Storing and retrieving data from array. Operations on Array: Addition, subtraction and multiplication of 2D array. Array of Pointers and Pointer to array.
Applications: Sparse Matrix: Concept, Representation using 2D array, Transpose and Fast Transpose. Single variable Polynomial: Concept, Representation using array, addition and multiplication of two single variable polynomials.
Case Studies: Use of sparse matrix in Social Networks and Maps.

Unit III:	**Searching and Sorting**	**[6 Hrs]**

Searching: Linear Search, Binary Search. **Sorting:** Concept, Types (Internal, External Sort), Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Bucket sort, Radix Sort.
Comparison of Complexities of all sorting techniques.
Case Studies: Timsort as a hybrid stable sorting algorithm

Unit IV:	**Linked List**	**[6 Hrs]**

Linked List: Pointer, Concept, Node structure, Types: Singly Linked List, Doubly Linked List, Circular Linked List, singly circular linked list, Doubly Circular linked list. Operations: Insertion (front, end or any location), Deletion (front, end and any location), Search, Traverse, Update.
Applications: Single Variable Polynomial: Concept, Representation using Linked List, addition of polynomials.
Generalized Linked List (GLL): Concept, Representation of polynomial using GLL.
Case Studies: Study the use of Linked List in Web Browser.

Text Books:

	1	Data Structures Using C++ by Dr. Varsha H. Patil Oxford University Press
	2	Fundamentals Of Data Structures In C++ Ellis Horowitz, Sartaj Sahni, Dinesh Mehta
	3	Data Structures Through C++ By G. S. Baluja
	4	Object Oriented Programming With C++ By E. Balagurusamy, McGraw-Hill Education

Reference Books:

	1	C++ The Complete Reference by Herbert Schildt , McGraw-Hill Education
	2	M. Weiss, —Data Structures and Algorithm Analysis in C++, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
	3	Aho, J Hopcroft, J.Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0

List of Assignment

1	Write a Program to perform following operation on numbers entered by user. It must be menu driven contains functions for each operation. 1.Entered number is Even/Odd 2.Calculate Factorial of entered Number 3. Entered Number is Armstrong Number or not 4. Entered Number is Palindrome or not 5. Reverse the entered number
2	Program to store marks scored in subject 'Data Structure' by n students in the class. Write a function to compute the following(Absent marked as 999) 1. Highest Score, Lowest Score in the class 2. Display marks with highest frequency in the class. 3. Average score in the class 4. Count number of absent, passed and failed students
3	Data Collected based on different parameters for analysis represented in matrix given below. 0 0 2 0 0 0 0 0 0 5 0 3 0 0 0 7 0 0 0 0 Program to represent this sparse matrix using 2D Array and perform transpose and fast transpose on it.
4	The ticket booking system of Volvo Bus has to be implemented using C++ program. There are 10 rows and 3 seats in each row. Implement a ticket booking system that displays the bus booking status after each operation 1. Make Booking 2. Cancel Booking 3. Show Total number of Booked seats 4. Show Total number of Empty seats
5	Program to store roll numbers of student in array who attended training program on Data Structure in random order. Write function to perform following operations 1. Search roll no is present or not using Linear Search 2. Search roll no is present or not using Binary Search 3. Sort stored roll no using Bubble Sort
6	Write a program to represent single variable polynomial using linked list and perform addition And multiplication.
7	Implement Circular Linked list for media player, each node contains information about song (Song ID, Song Name, Movie Name, Play Time). 1. Insert song in playlist 2. Delete Song in Playlist 3. Display Play List of songs

CD12235: Fundamentals of Data Science	
Teaching Scheme	**Examination Scheme**
Credits: 3	Continuous Internal Evaluation (CIE): 20 Marks
Lectures: 2 Hrs/week	In-Semester Examination (ISE): 20 Marks
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): 20 Marks
	End Semester Examination (ESE): 40 Marks
	TW: 25 Marks

Prerequisites:	
•	Basic understanding of data concepts and terminology.
•	Proficiency in using a programming language (preferably Python).
•	Familiarity with basic statistics and mathematics.

Course Objectives:	
•	Gain a clear understanding of core concepts and terminologies in data science
•	Learn various data collection, cleaning, and preprocessing techniques.
•	Learn about statistical modeling and machine learning concepts.
•	Acquire skills to create effective data visualizations for communicating insights.

Course Outcomes:	
	After completion of the course, student will be able to
1.	Gain the ability to explain key data science concepts and differentiate between different types of learning
2.	Acquire proficiency in data collection, preprocessing, and handling missing data and outliers
3.	Develop the skills to build basic statistical models for prediction and classification and understand model evaluation concepts
4.	Attain the capability to create effective data visualizations using various tools and techniques to communicate insights clearly

Unit I:	**Introduction to Data Science**	**[3h]**
What is Data Science?, Importance of Data Science, Applications in industries and data-driven decision-making, Data Science Life Cycle, Components of Data Science **Case Studies:** Predictive Maintenance in Manufacturing.		
Unit II:	**Data Collection and Cleaning**	**[4h]**
Data Sources and Types, Data Collection Techniques, Data Cleaning and Pre-processing Handling missing data, outliers and transformations **Case Studies:** Social Media Sentiment Analysis.		
Unit III:	**Exploratory Data Analysis and Statistical Modeling**	**[6h]**

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Importance of EDA, Descriptive Statistics, Understanding Distributions and Patterns, different techniques for exploratory data analysis, How to build statistical models to make predictions, The different types of statistical models

Case Studies: How data science is used to identify fraudulent transactions

Unit IV:	**Machine Learning and Data Visualization**

Introduction to Machine Learning, Types of Machine Learning, How to use machine learning algorithms to automate tasks, Use of Data visualization to communicate insights, The different techniques for data visualization, Tools for Data Visualization

Case Studies: Housing Market Analysis

Text Books:		
	1	Steven S. Skiena, "The Data Science Design Manual", Springer 2017
	2	Rachel Schutt & O'neil, "Doing Data Science", Straight Talk from The Frontline O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013
Reference Books:		
	1	Joel Grus," Data Science from Scratch" First Edition, April 2015
	2	Gareth James, Daniela Witten, Trevor Hatie, RoberstTibhirani , "An Introduction to Statistical Learning-with Applications in R", 2013
	3	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2 edition (30 September 2014)
Online Resources:		
	1	"Data science for engineers" https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/

List of Assignment

1	Write a paragraph explaining what data science is and give one example of how it's used in everyday life
2	Collect data about the number of steps you take each day for a week. Remove any days with missing data and create a simple line graph to show the trend
3	Calculate the average score of a small set of test scores. Make a bar chart to display the scores and identify which score occurs most often
4	Choose a dataset with information about different animals and whether they can fly. Use a basic rule (e.g., if wingspan > 20 cm, it can fly) to predict if an animal can fly or not. Show your prediction accuracy in a pie chart
5	Write a few sentences about why it's important to keep personal information private when using apps or websites
6	Survey five friends about their favorite colors. Present the results in a simple table or list
7	Count the number of times each letter appears in a paragraph of text. Display the frequencies in a bar chart
8	Use a small dataset with information about different types of weather (e.g., sunny, rainy). Predict the weather based on the temperature. Show your predictions using a basic line chart

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

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CD12236: Data Visualization	
Teaching Scheme	**Examination Scheme**
Credits: 2	Continuous Internal Evaluation (CIE):NA
Lectures: 1 Hrs/week	In-Semester Examination (ISE): NA
Practical: 2 Hrs/week	Skills & Competency Exam (SCE): NA
	End Semester Examination (ESE):NA
	TW: 50 Marks

Prerequisites:	
	Fundamentals of programming

Course Objectives:	
	To understand components of data visualization
	To learn various tools and techniques of data visualization

Course Outcomes:	
	After completion of the course, student will be able to
1.	Design and create data visualizations.
2.	Apply data visualization techniques in various domains.

Unit I:	**FOUNDATIONS OF DATA VISUALIZATION**

. Overview of Data Visualization, Need of data visualization, The Human Brain and Data Visualization, The Shapes of Data, Inputs for data visualization, Types of Visualizations: Cognitive vs Perceptual Design Distinction, Examples of the Types of Visualizations, 5 big data visualization categories: temporal, hierarchical, network, multi-dimensional and geospatial, Practicing Good Ethics in Data Visualization, Ineffective Visuals and How to Improve Them, Principles of Visual Perception, Colour as a Pre-Attentive Attribute, Strategic Use of Contrast, Tools for Visualizing: PowerBI, Tableau etc.,

Case Study: Enhancing Business Insights Through Data Visualization

Unit II:	**BEST PRACTICES OF DATA VISUALIZATION**

Gestalt Principle: Proximity, Accessible Visualizations, Aesthetic, Design and Exploratory Analysis, Introduction, Exploratory and Explanatory Analysis, Data, Relationships and Design Static Versus Interactive Visualizations, bringing everything together in a dashboard, moving from Foundational to Advanced Visualizations: Bar charts, Gantt charts, Stacked bars, Tree maps, Area charts, Pie charts; Visualizing distributions: Circle charts, Jittering, Box and whisker plots, Histograms.

Case Studies: Enhancing Sales Strategy Through Interactive Visualizations

Text Books:		
	1	Fundamentals of Data Visualization by Claus O. Wilke, April 2019, O'Reilly Media, Inc., ISBN: 9781492031086
	2	Communicating Data with Tableau: Designing, Developing, and Delivering Data Visualizations, Ben Jones

Reference Books:		
	1	The Big Book of Dashboards, Steve Wexler, Jeffrey Haffer, Andy Cotgreave
	2	Practical Tableau, Ryan Sleeper

	3	https://www.tableau.com/learn/articles/interactive-map-and-data-visualization-examples Home
Online Resources:		
	1	Tableau for Beginners – Data Visualisation made easy: https://www.analyticsvidhya.com/blog/2017/07/data-visualisation-made-easy/
	2	https://rafalab.github.io/dsbook/ggplot2.html#aesthetic-mappings

List of Assignments:

1	Case study: Compare various data visualization tools. Study any one of the tools in detail.
2	Download any free dataset (from Kaggle/tableau etc.) in excel format. Explore and analyse this data using Excel or simply by hand (drawing pictures is fine).
3	Visualize the downloaded dataset from assign2 by applying following graph types: (select any 8) 1. Bar Chart 2. Line Chart 3. Scatterplot 4. Sparkline 5. Pie Chart 6. Gauge 7. Waterfall Chart 8. Funnel Chart 9. Heat Map 10. Histogram 11. Box Plot 12. Maps 13. Tables 14. Indicators 15. Area Chart 16. Radar or Spider Chart 17. Tree Map
4	Download any free dataset (from Kaggle/ tableau etc.) and visualize using temporal category: Scatter plots, Polar area diagrams, Time series, sequences, Line graphs.
5	Visualize the dataset using temporal category and Timelines tools
6	Visualize the dataset using hierarchical category: Tree diagrams and Ring charts
7	Visualize the dataset using multidimensional category: Scatter plots, Pie charts, histograms
8	Plot the visualization graph using aesthetics, labels and titles, categories as colours