Second Year in B. Tech. (Computer Engineering) Syllabus
Aligned with New Education Policy 2020
With effective from 2024 - 2025

(University Department only)

Department of Computer Engineering

Dr. Babasaheb Ambedkar Technological University, Lonere - 402103

www.cse.dbatu.ac.in

First Year in B. Tech. in Computer Engineering
Course Curriculum Aligned with New Education Policy 2020
(with effective from Academic Year 2023 - 2024)

First Semester

Course Code	Course Name	Weekly Hours		Examination Scheme			Credit
		L	P	CA	MSE	ESE	
23UD1245BS101	Environmental Science and Engineering	2	-	20	20	60	2
23UD1245BS102	Set Theory and Logic	3	-	20	20	60	3
23UD1245ES103	Engineering Mathematics - I	4	-	20	20	60	4
23UD1245ES104	Engineering Chemistry	3	-	20	20	60	3
23UD1245ES105	Digital Electronics	3	-	20	20	60	3
23UD1245VE106	C Programming	1	2	60	-	40	2
23UD1245BS107	Engineering Chemistry Lab	-	2	60	-	40	1
23UD1245BS108	Environmental Science and Engineering Lab	-	2	60	-	40	1
23UD1245ES109	Digital Electronics Lab	-	2	60	-	40	1
23UD1245CC110	A. NSS B. NCC C. Yoga Education	1	2	60	-	40	2
	Total	**17**	**10**	**340**	**100**	**460**	**22**

Course Type and Acronyms used

1. Basic Science Course (BSC)
2. Engineering Science Course (ESC)
3. Program Core Course (PCC)
4. Vocational Skill Enhancement Course (VSEC)
5. Co-curricular Course (CC)
6. Ability Enhancement Course (AEC)
7. Indian Knowledge System (IKS)

L - Lecture,
P / PR - Practical,
CA - Continuous Assessment, TH - Theory,
MSE - Mid Semester Examination,
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Second Semester

Course Code	Course Name	Weekly Hours		Examination Scheme			Credit
		L	P	CA	MSE	ESE	
23UD1245BS201	Statistics and Probability	3	-	20	20	60	3
23UD1245AE202	Communication Skills	2	-	20	20	60	2
23UD1245ES203	Engineering Mathematics- II	4	-	20	20	60	4
23UD1245ES204	Engineering Physics	3	-	20	20	60	3
23UD1245PC205	OOP in C++	3	-	20	20	60	3
23UD1245VE206	Web Site Development and MS Office	1	2	60	-	40	2
23UD1245BS207	Engineering Physics Lab	-	2	60	-	40	1
23UD1245BS208	Data Science with Python	-	2	60	-	40	1
23UD1245PC209	OOP Lab	-	2	60	-	40	1
23UD1245AE210	Communication Skills Lab	-	2	60	-	40	1
23UD1245IK211	Hindustani Music	-	2	60	-	40	1
Total		**16**	**12**	**460**	**100**	**540**	**22**
Exit Requirements for Certificate program (any two courses from following courses)							
23UD1245VE212	Mobile Application Development for iOS Devices	1	6	60	40	-	4
23UD1245VE213	Mobile Application Development for Android Devices	1	6	60	40	-	4
23UD1245VE214	Drone Technology	1	6	60	40	-	4
23UD1245CC212	Entrepreneurship	1	6	60	40		4

Course Type and Acronyms used

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Third Semester

Course Category	Course Code	Course Name	Weekly Hours		Examination Scheme			Credit
			L	P	CA	MSE	ESE	
BSC	24UD1000BS301	Engineering Mathematics-III	3	-	20	20	60	3
PCC1	24UD1245PC302	Data Structures and Algorithm	3	-	20	20	60	3
PCC2	24UD1245PC303	Computer Architecture and Organization	3	-	20	20	60	3
ESC	24UD1245ES304	Data Communication	3	-	20	20	60	3
Open Elective	24UD1SCIOE305	Quantum Computing	2	-	20	20	60	2
MDM	24UD1245MD306	Python Programming	2	-	20	20	60	2
Entrepreneurship / Economics / Management	24UD1245AE307	Business Economics	2	-	20	20	60	2
VSEC	24UD1245AE308A	Life of Chhatrapati Shivaji Maharaj	1	-	50	-	-	1
PCC Lab	24UD1245PCL309	Data Structure and Algorithm Lab	-	2	40	-	60	1
VSEC	24UD1UHVVE310	UHV - II	3	-	20	20	60	3
PCC Lab	24UD1245PCL311	IDEA Lab	-	2	40	-	60	1
CEP/FP	24UD1245CP312	Seminar	-	2	40	-	60	1
		Total	**22**	**6**	**330**	**160**	**660**	**25**

Course Type and Acronyms used

8. Basic Science Course (BSC)
9. Engineering Science Course (ESC)
10. Program Core Course (PCC)
11. Vocational Skill Enhancement Course (VSEC)
12. Co-curricular Course (CC)
13. Ability Enhancement Course (AEC)
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Fourth Semester

Course Categories	Course Code	Course Name	Weekly Hours		Examination Scheme			Credit
			L	P	CA	MSE	ESE	
PCC1	24UD1245PC401	Design and Analysis of Algorithms	3	-	20	20	60	3
PCC2	24UD1245PC402	Discrete Mathematics	3	-	20	20	60	3
PCC3	24UD1245PC403	Database Management System	3	-	20	20	60	3
Entrepreneurship / Economics / Management	24UD1245AE404	Principle of Management	2	-	20	20	60	2
Open Elective	24UD1245OE405	Numerical Methods	2	-	20	20	60	2
MDM	24UD1245MD406	Data Structures	2	-	20	20	60	2
VSEC	24UD1COIVE407	Constitution of India	1	-	50	-	-	Audit
VSEC	24UD1000VE408B	Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	-	50	-	-	1
VSEC	24UD1245S409	Competitive Programming	1	2	40	-	60	2
AEC	24UD1000AE410	Modern Indian Languages A) Marathi B) Hindi C) Sanskrit	2	-	20	20	60	2
VSEC	24UD1245S411	Full Stack Development	1	2	40	-	60	2
PCC Lab	24UD1245PCL412	Design and Analysis of Algorithms Lab	-	2	40	-	60	1
PCC Lab	24UD1245PCL413	Database Management System Lab	-	2	40	-	60	1
Total			**21**	**8**	**400**	**140**	**660**	**24**
	Exit Requirements for Certificate program							
VSEC	23UD1245VE412	Full Stack Development Project		16	60		40	8

Course Type and Acronyms used

15. Basic Science Course (BSC)
16. Engineering Science Course (ESC)
17. Program Core Course (PCC)
18. Vocational Skill Enhancement Course (VSEC)
19. Co-curricular Course (CC)
20. Ability Enhancement Course (AEC)
21. Indian Knowledge System (IKS)

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Teaching Scheme		Semester I Environmental Science and Engineering	Examination Scheme	
TH	2	**Course Objectives:**	CA	20
PR	2	1. To create awareness of environmental catastrophes and climate change.	MSE	20
CR	3	2. Identify and analyze the different segments that constitute the environment and their interrelationships.	ESE	60
		3. Recognize the value of biodiversity in maintaining ecosystem resilience and providing ecosystem services.		
		4. Identify sources and causes of soil, water, air pollution and their effects on quality and agricultural productivity.		
		5. Evaluate various approaches to solid waste management, including recycling, composting, and waste reduction.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Environment:** Introduction, Components of Environment, Types of Environment, Brief discussion on Segments of Environment, Environmental Pollution, Ecosystem-Types of Ecosystem, Components of Ecosystem.	03 Hrs
2	**Air Pollution:** Introduction, Brief discussion on air pollutants, Sources of Air Pollution- Pollutants from Industry, Pollution by Automobiles; Effect of Air Pollutions-Acid rain, Green-House Effect, Global warming; Brief discussion on Control of Air Pollution.	04 Hrs
3	**Water Pollution:** Introduction, Types of Water Pollutants, Sources of Water Pollution, Methods to remove impurities in water, Treatment of Waste-water, Impact of Water Pollution on Human Health, Water as a carrier for the transmission of diseases.	03 Hrs
4	**Soil and Noise Pollution:** Sources of Soil Pollution, Harmful Effects of Soil Pollution, Control of Soil Pollution, Noise Pollution- Sources, Effects and Control Measures of Noise Pollution.	03 Hrs
5	**Solid Waste Management:** Classification of Solid Waste- Sources and Types of Solid Waste, Causes of Solid Waste Management- Disposal of Solid Waste, Recycling of Solid Waste Awareness of Environment, Role of Individuals in Pollution Prevention.	03 Hrs

Text Books:

1. Environmental Science, V. K. Ahluwalia and Sunita Malhotra.
2. Environmental Chemistry (Sixth Edition), A. K. De.
3. Essential Environmental Studies, S. P. Mishra and S. N. Pandey.

Teaching Scheme		Semester I Set Theory and Logic	Examination Scheme	
TH	3	**Course Objectives:** 1. Analyze the logical structure of statements symbolically, including the proper use of logical connectives, predicates, and quantifiers. 2. Construct truth tables, prove or disprove a hypothesis, and evaluate the truth of a statement using the principles of logic. 3. Properly use higher mathematics vocabulary and symbolic notation in definitions, theorems, and problems. 4. Solve problems and write proofs using the concepts of set theory, including the methods of Venn diagrams and truth tables.	CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Propositional Logic:** Propositions, truth values, Truth tables for operators, Truth Tables of Compound Propositions, Precedence of Logical Operators. **Propositional Equivalences:** Logical Equivalences, Constructing New Logical Equivalences. **Propositional Calculus:** Normal Forms, Predicates.	08 Hrs
2	**Predicates and Quantifiers:** Predicates, Quantifiers: Universal and Existential, Quantifiers with Restricted Domains, Precedence of Quantifiers, Binding Variables, Logical Equivalences Involving Quantifiers, Negating Quantified Expressions, Translating from English into Logical Expressions, Examples from Lewis Carroll, Nested Quantifiers: Understanding Statements Involving Nested Quantifiers, The Order of Quantifiers, Negating Nested Quantifiers.	07 Hrs
3	**Rules of Inference:** Valid Arguments in Propositional Logic, Rules of Inference for Propositional Logic, Using Rules of Inference to Build Arguments, Resolution, Fallacies.	06 Hrs
4	**Basic notions in set Theory:** Sets, Venn Diagrams, Subsets, The Size of a Set, Power Sets, Cartesian Products, Set operations, Set Identities, Generalized Unions and Intersections, Cardinality of Sets.	05 Hrs
5	Mathematical Induction, Basic Counting Principles, The Pigeonhole Principle.	05 Hrs

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010.

3. Y. N. Singh, Discrete Mathematical Structures, Wiley Publication, 1st Edition, 2010.
4. Dr. Sukhendu Dey, Graph Theory with Applications, SPD Publication, 1st Edition, 2012.

Teaching Scheme		Semester I Engineering Mathematics - I	Examination Scheme	
TH	4	**Course Objectives:**	CA	20
PR	-	1. To know the application of Linear algebra to find solutions to a system of linear equations arising in engineering problems.	MSE	20
CR	4	2. To know and apply the concept of partial derivatives and their applications to Maxima/Minima, series expansion of multi-valued functions.	ESE	60
		3. To understand the Computation of Jacobian functions of several variables and their applications to engineering problems		
		4. To identify and sketch curves in various coordinate systems.		
		5. To evaluate multiple integrals and their applications to area and volume.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Linear Algebra- Matrices:** The inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix; Consistency of non-homogeneous and homogeneous systems of linear equations; Eigenvalues and eigenvectors; Properties of eigenvalues and eigenvectors (without proofs); Cayley- Hamilton‟s theorem (without proof) and its applications.	07 Hrs
2	**Partial Differentiation:** Partial derivatives of first and higher orders; Homogeneous functions– Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.	07 Hrs
3	**Applications of Partial differentiation:** Jacobians properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.	07 Hrs
4	**Reduction Formulae and Tracing of Curves** Reduction formula for $\int_0^{\frac{\pi}{2}} sin^n x\,dx$, $\int_0^{\frac{\pi}{2}} cos^n x\,dx$, and $\int_0^{\frac{\pi}{2}} sin^m x\,cos^m x\,dx$; Tracing of standard curves given in the cartesian, parametric and polar form.	07 Hrs
5	**Multiple Integra**: Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral; Applications of multiple integrals to find area as double integral, volume as triple integral and surface area.	07 Hrs

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O'Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

Teaching Scheme		Semester I Engineering Chemistry	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	2	1. To impart knowledge of chemistry in Engineering and Technology.	MSE	20
CR	4	2. To enable the student to explain the importance of chemistry in various fields of Engineering.	ESE	60
		3. To identify the chemistry concept to lay the groundwork for subsequent studies.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Water Treatment:** Introduction, Hard and soft water, Disadvantages of hard water, Softening of water – Ion exchange process, Hot lime –soda process, Hardness and its determination by EDTA method, Dissolved oxygen (DO) and its determination by Winkler's method, Numerical based on hardness, Sewage water treatment.	07 Hrs
2	**Corrosion and its Control:** Introduction, Fundamental reason for corrosion, Electrochemical corrosion (Wet Corrosion), Mechanism of Wet corrosion, Direct Chemical corrosion (Dry corrosion), Factors affecting the rate of corrosion, Types of corrosion-Pitting corrosion, Microbiological corrosion, Methods to minimize the rate of corrosion- Proper designing, Cathodic, and anodic protection method.	07 Hrs
3	**Fuels and Lubricants:** **Fuels:** Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel, Solid fuel- Coal and various types of coal, Analysis of coal- Proximate and Ultimate analysis, Liquid fuel- Refining of petroleum. **Lubricants:** Introduction, classification of lubricants-Solid, Semi-solid, and Liquid lubricants, Properties of lubricants: Physical properties–viscosity, viscosity index, surface tension, Flashpoint, and Fire point, Chemical properties – acidity, saponification value.	07 Hrs
4	**Electrochemistry:** Introduction, Electrical conductance, Conductance measurement by Wheatstone bridge method, Cell constant, Conductometric titrations, Glass electrode and its application for pH measurement, Ostwald's theory of acid-base indicator, Rechargeable batteries i) Lithium-ion battery ii) Lithium battery, Fuel cell (H_2-O_2), Advantages of fuel cell.	08 Hrs

5	**Instrumental Methods of Analysis:** UV-Visible spectroscopy-Introduction, Laws of absorption -Beer's - Lambert's law, Instrumentation and working of double beam spectrophotometer. Flame Photometry (Flame emission spectroscopy): Introduction, Principle, and Working. Chromatography: Introduction, Classification, Thin layer chromatography (TLC), Brief discussion on IR spectroscopy.	07 Hrs

Text Books:

1. Jain P. C., Jain Monica, Engineering Chemistry, Dhanpat Rai; Sons, Delhi, 1992.
2. Bhal & Tuli, Textbook of Physical Chemistry, S. Chand; Company, New Delhi.
3. Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, Cambridge Publishers - 2015.
4. Gurudeep Chatwal and Sham Anand, Instrumental methods of Chemical Analysis, Himalaya Publishing House, New Delhi.

Reference Books:

1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi.
2. O. G. Palanna, Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
3. WILEY, Engineering Chemistry, Wiley India, New Delhi 2014.
4. S.S.Dara, Engineering Chemistry, McGraw Hill Publication, New Delhi.
5. Willard, Hobart H.; Merritt, Lynne L., Jr.; Dean, John A. Instrumental Methods of Analysis, American Chemical Society.

Engineering Chemistry Lab (2 Hrs / Week, Credit 1)

List of Experiments: (Perform any 9 – 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of Chloride content in a water sample by precipitation titration method.
3. Determination of Dissolved Oxygen in water by Iodometric method.
4. Determination of Percent purity of Bleaching Powder.
5. pH – metric Titration (Acid-Base titration)
6. Conductometric Titration (Acid-Base titration)
7. Surface tension
8. Viscosity
9. To determine the Acidity of the water sample.
10. To determine the Calorific value of a fuel.
11. Determination of the Acid value of an oil sample.
12. Determination of the Saponification value of an oil sample.
13. To verify Beer's-Lambert's law.
14. To determine the Alkalinity water sample.
15. Determination of the rate of corrosion of metal.

16. To determine the maximum wavelength of absorption of a given solution by a colorimeter.
17. Experiment on Chromatography.

Teaching Scheme		Semester I Digital Electronics	Examination Scheme	
TH	3	**Course Objectives:** 1. To acquaint the students with the fundamental principles of two-valued logic and various devices to implement logical operations on variables. 2. To lay the foundation for further studies in areas such as communication, VHDL, and computer. 3. Understand the principles of asynchronous counters and design them to meet specific counting requirements. 4. Solve real-world problems related to arithmetic operations, code conversion, counter applications, and other digital logic scenarios.	CA	20
PR	2		MSE	20
CR	4		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction:** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates.	07 Hrs
2	**Number Systems:** binary, signed binary, octal hexadecimal number, binary arithmetic, one‘s and two‘s complements arithmetic, codes, error detecting and correcting codes	07 Hrs
3	**Combinational Logic Design:** Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto four variables), don’t care conditions	07 hrs
4	**Design Examples:** Arithmetic Circuits, BCD-to-7 segment decoder, Code converters. Adders and their use as subtractors, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and Demultiplexers, and Decoders.	07 Hrs
5	**Sequential Circuits and Systems:** 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J-K-T, and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, a special counter IC‘s, asynchronous sequential counters, applications of counters.	07 Hrs

Text Book:

1. R. P. Jain, Modern Digital Electronics, McGraw Hill Education, 2009.
2. M. Morris Mano, Digital Logic and Computer Design 4th edition, Prentice Hall of India, 2013.

3. Anand Kumar, Fundamentals of digital circuits 1st edition, Prentice Hall of India, 2001.
4. Pedroni V.A., Digital Circuit Design with VHDL, Prentice Hall India, 2nd Edition 2001.

Digital Electronics Lab (2 Hrs / Week, Credit 1)

List of Experiments:

1. Study of gates – AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR.
2. Verification of Boolean Theorems using basic gates.
3. Design a circuit to convert a binary number to its two's complement representation.
4. Design and realize a given function using K-maps and verify its performance.
5. Verify
    a. Demorgan's Theorem for 2 variables.
    b. The sum-of product and product-of-sum expressions using universal gates.
6. Design and implement
    a. Full Adder using basic logic gates.
    b. Full subtractor using basic logic gates.
7. Implementation of 4x1 multiplexer using Logic Gates.
8. To verify the truth tables of S-R; J-K; T and D type flip flops.
9. Design, and Verify the 4- Bit Synchronous Counter.
10. Design, and Verify the 4-Bit Asynchronous Counter.
11. Design and implementation of a simple digital system (Mini Project).

Teaching Scheme		Semester I C Programming	Examination Scheme	
TH	1	**Course Objectives:**	CA	60
PR	2	1. To give a broad perspective about the uses of computers in the engineering industry and C Programming.	MSE	-
CR	2	2. To develop the basic concept of algorithm, algorithmic thinking, and flowchart.	ESE	40
		3. To apply C programming language to implement various algorithms and develop general programming concepts and terminology.		
		4. To make familiar the more advanced features of the C language.		
		5. To identify tasks in which the numerical techniques learned are applicable, apply them to write programs, and hence use computers effectively to solve the task.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Process of programming:** Editing, Compiling, Error Checking, executing, testing, and debugging programs, IDE commands, Eclipse for C Program development, Flowcharts, and Algorithms.	04 Hrs
2	**Types, Operators, and Expressions:** Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators, and expressions, conditional expressions precedence and order of evaluation.	07 Hrs
3	**Control Flow:** Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue goto and Labels; Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules.	07 Hrs
4	**Arrays in C:** Initializing and accessing elements from one-dimensional arrays and two-dimensional arrays, Initializing character arrays, and multidimensional arrays.	07 Hrs
5	**Structures C:** Basics of structures, structures, and functions arrays of structures, Pointer in C; Pointers to integers, characters, floats, arrays, structures.	07 Hrs

Text / Reference Books:

1. Brain W. Kernighan & Dennis Ritchie, The C Programming Language, Prentice Hall, 2nd Edition, 1988.
2. R. S. Bichkar, Programming with C, Orient Blackswan, 1st Edition, 2012.

3. Herbert Schildit, C The Complete Reference, McGraw-Hill Publication, 2000.
4. Balguruswamy, Programming in C, McGraw Hill Education India Private Limited; Seventh edition, 2017.
5. Yashwant Kanitkar, Let Us C, 16th Edition, BPB Publications, 2018.

C Programming Lab (2 Hrs / Week, Credit 1)

At least 10 experiments should be performed from the following list.

List of Experiments:

1. Assignment on the Flowchart and algorithm.
2. A Simple program to display a "Hello world" message on the screen.
3. A Program to take input from the user and display the value entered by a user on screen.
4. Basic example for performing different C Operations using an operator. (With and without using scanf()).
5. Basic Program on Operators. (Using scanf()).
    a. Program to find and print the area, perimeter, and volume of geometric objects.
    b. Program to check whether a number entered by the user is a Perfect number.
6. Program to find the maximum and minimum between two numbers the user gives using if-else and conditional Operators.
7. Program to swap two numbers.
8. Program to print the square and factorial of an entered number using a while loop.
9. Program to check whether a number is a Palindrome number.
10. Program to check Armstrong number.
11. Program to check and generate prime numbers up to n.
12. Program to find the GCD of two entered numbers.
13. Program to find maximum and minimum from n entered numbers.
14. Program to print alternate numbers from n entered numbers.
15. Program to print addition, subtraction, and multiplication of Matrices.
16. Program to find the length of the string. (With and without using the library function).
17. Programs demonstrating the use of Structures, Arrays of Structures, and Structure containing arrays.
18. Programs demonstrating pointers to integers, floats, char, strings, structures, and Arrays.

Teaching Scheme		Semester I Yoga	Examination Scheme	
TH	1	**Course Objectives:**	CA	60
PR	2	1. To apply the techniques in yoga for self-improvement and managing emotions, stress, and life.	MSE	-
CR	2	2. Analyze the concepts of First and Second Wave Positive Psychology and their relevance to personal well-being.	ESE	40
		3. Develop a comprehensive understanding of the synergy between Yogic practices and Positive Psychology interventions.		

COURSE CONTENT

Unit No.	Topic	Hours
1	Managing Self through Yoga, Why Positive Psychology and Yoga in this Course? Positive Psychology: First and Second Wave, Yoga from the Lens of Positive Psychology, Yogic Perspective of Positive Events and Positive Institutions, Yogic Perspective of Governance and Micro Macro Integration of Life.	05 Hrs
2	Health and Wellbeing: Perspectives from Positive Psychology, Yoga and Ayurveda, Human Self and Ladder of Joy: Yogic, Sankhya and Vedantic Perspective, TattvaBodha and Indrajaya: Ways of Attaining Wellbeing, Dharmah Kriya, and Sukhayu-Hitayu: Ways of Attaining Wellbeing.	06 Hrs
3	Kleshas: The Obstacles on the Way of Attaining Wellbeing, Shat Sampatti: The Means to Surpass the Obstacles on the Way of Attaining Wellbeing, Realms and Types of Interventions for Managing Self and Career, Food as the First Intervention for Managing Self, Asanas as the Intervention for Managing Self and Career.	02 Hrs
4	Prana and Types of Pranayam, Pranayams as the Intervention for Managing Self and Career, Pratyahara as the Intervention for Managing Self and Career.	07 Hrs
5	Yogic Intervention for Managing Emotions, Yogic Intervention for Making Mind a Friend.	04 Hrs

Text Books:

1. Rao, K. R., & Paranjpe, A. C. (2016), Psychology in the Indian tradition, Springer India.
2. Parker, S. (2015). Clearing the Path: The Yoga Way to Clear and Pleasant Mind. Lotus Press.
3. Cornelissen, M. (2011). Foundations of Indian Psychology, vol. 2, Practical Applications. Pearson Education India.

Semester - II

Teaching Scheme		Semester II Statistics and Probability	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	-	1. To explain basic concepts in statistics and probability. 2. To describe various probabilistic distributions.	MSE	20
CR	3	3. To apply regression and correlation techniques.	ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Probability Theory** Definition of probability: classical, empirical, and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes' theorem of inverse probability, Properties of probabilities with proofs, Examples.	10 Hrs
2	**Random Variable and Mathematical Expectation:** Random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Join and marginal probability distributions, Properties of expectation and variance with proofs.	06 Hrs
3	**Theoretical Probability Distributions:** Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, Examples.	10 Hrs
4	**Correlation:** Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient, Probable errors.	06 Hrs
5	**Linear Regression Analysis:** Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.	06 Hrs

Text Books:

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.
2. G. V. Kumbhojkar; Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2010.
5. G. Haribaskaran; Probability, Queuing Theory and Reliability Engineering, Laxmi Publications, 2nd Edition, 2009.
6. Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability And Statistics, Schaum's Outlines, 4th Edition, 2013.

Teaching Scheme		Semester II Communication Skills	Examination Scheme	
TH	2	**Course Objectives:**	CA	20
PR	2	1. To know and apply speaking and writing skills in professional and social situations.	MSE	20
CR	3	2. To Overcome Mother Tongue Influence and demonstrate a neutral accent while exercising English.	ESE	60
		3. To know and apply communication skills for Presentations, Group Discussions, and interpersonal interactions.		
		4. To know and apply grammar correctly during Speaking and Writing situations, especially in context with Presentations, Public Speaking, Report writing, and Business Correspondence.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Communication and Communication Processes**: Introduction to Communication, Forms, and functions of Communication, Barriers to Communication and Overcoming them, Verbal and Non-verbal Communication Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension; Listening: Importance of Listening, Types of Listening, Barriers to Listening.	04 Hrs
2	**Verbal & Non-verbal Communication:** Use of Language in Spoken Communication, Principles and Practice of Group Discussion, Public Speaking (Addressing Small Groups and Making Presentation), Interview Techniques, Appropriate Use of Non-verbal Communication, Presentation Skills, Extempore, Elocution.	04 Hrs
3	**Study of Sounds in English** Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.	02 Hrs
4	**English Grammar** Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Synonyms and Antonyms, Common Errors.	05 Hrs
5	**Writing Skills, Reading Skills & Listening Skills** Features of Good Language, Difference between Technical Style and Literary Style, Writing Emails, Formal and Informal English, Technical Reports; Report Writing: Format, Structure, and Types; Letter Writing: Types, Parts, Layouts, Letters and Applications, Use of Different Expressions and Style, Writing Job Application Letter and Resume.	04 Hrs

Text Book:

1. Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill.

Reference Books:

1. Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016.
2. Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017.
3. Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010.
4. Anderson Kenneth Joan Maclean and Tony Lynch, *Study Speaking: A Course in Spoken English for Academic Purposes*. 2nd ed. 3rd pr ed. Cambridge: Cambridge University Press, 2007.
5. Aswathappa, K. Organizational Behavior, Himalayan Publication, Mumbai (1991).
6. Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).
7. Balan K. R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).
8. Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
9. Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2, Macmillan, 1975.
10. Blass, Laurie, Kathy Block, and Hannah Friesan. Creating Meaning. Oxford: OUP, 2007.
11. Bovee Courtland, L and Thrill, John V. Business Communication, Today McGraw Hill, New York, Taxman Publication (1989).

Communication Skills Lab (2 Hrs / Week, 1 Credit)

List of Experiments:

1. How to introduce oneself ? (02 hrs)
2. Know your friend (02 hrs)
3. Introduction to Phonemic symbols (02 hrs)
4. Articulation of sounds in English with proper manner (02 hrs)
5. Practice and exercises on articulation of sounds (02 hrs)
6. Read Pronunciations/transcriptions from the dictionary (02 hrs)
7. Practice and exercises on pronunciations of words (02 hrs)
8. Introduction to stress and intonation (02 hrs)
9. Rapid reading sessions (02 hrs)
10. Extempore (02 hrs)
11. Group discussion (02 hrs)
12. Participating in a debate (02 hrs)
13. Presentation techniques (02 hrs)
14. Interview techniques (02 hrs)

Teaching Scheme		Semester II Engineering Mathematics - II	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	-	1. To know and discuss the need and use of complex variables to find roots, separate complex quantities, and establish a relation between circular and hyperbolic functions.	MSE	20
CR	3	2. To understand and solve first and higher-order differential equations and apply them as mathematical modeling in electric and mechanical systems.	ESE	60
		3. To determine the Fourier series representation of periodic functions over different intervals.		
		4. To Demonstrate the concept of vector differentiation and interpret the physical and geometrical meaning of gradient, divergence & curl in various engineering streams.		
		5. To know and apply the principles of vector integration to transform line integral to surface integral, surface to volume integral & vice versa using Green's, Stoke's, and Gauss divergence theorems.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Complex Number:** Definition and geometrical representation; De-Moivre's theorem (without proof); Roots of complex numbers by using De-Moivre's theorem; Circular functions of a complex variable – definition; Hyperbolic functions; Relations between circular and hyperbolic functions; Real and imaginary parts of circular and hyperbolic functions; Logarithm of Complex quantities.	07 Hrs
2	**Ordinary Differential Equations of First Order and First Degree and Their Applications:** Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations; Applications to orthogonal trajectories, mechanical systems, and electrical systems.	07 Hrs
3	**Linear Differential Equations with Constant Coefficients:** Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and Legendre's linear equations.	07 Hrs
4	**Fourier Series:** Introductory remarks, Euler's formula; Conditions for Fourier series expansion: Dirichlet's conditions; Functions having points of discontinuity; Change of interval; Odd and even functions expansions of odd and even periodic functions; Half-range series.	07 Hrs

5	**Vector Calculus:** Scalar and vector fields: Gradient, divergence, and curl; Solenoidal and irrotational vector fields; Vector identities (statement without proofs); Green's lemma, Gauss divergence theorem, and Stokes theorem (without proofs)	07 Hrs

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol II) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O'Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

Teaching Scheme		Semester II Engineering Physics	Examination Scheme	
TH	3	**Course Objectives:** 1. To provide a firm grounding in the basic physics principles and concepts to resolve many Engineering and Technological problems. 2. To understand and study the Physics principles behind the developments of engineering materials.	CA	20
PR	2		MSE	20
CR	4		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Engineering Optics:** Interference: in a thin film due to reflected light, wedge-shaped film, Newton's Rings, Applications, Polarization: types of polarization, optical activity, specific rotation, and Laurentz half shade polarimeter, Lasers: characteristics, Gas Laser, solid state Laser, and semiconductor lasers, Applications of Lasers, Optical fibers: Acceptance cone, Numerical aperture, applications, Oscillations: free oscillations, forced oscillations and damped oscillation, resonance and it's condition.	10 Hrs
2	**Quantum Mechanics:** Wave and particle duality of radiation – de Broglie concept of matter waves – Wave function and its physical significance, Heisenberg's uncertainty principle and its application – Schrodinger's wave equation – eigenvalues and eigenfunctions, particle confined in one dimensional infinite square well potential, Introduction to quantum computing.	06 Hrs
3	**Electromagnetism:** Differential and integral calculus: Operator, Concept of gradient, divergence, and curl, Ampere's law, Faraday law, Gauss–Divergence theorem, integral and differential forms of Maxwell equations and their physical significance, EM waves in free space. Dielectrics: polarization, Types of Dielectric polarization, dielectric constant, polar, non-polar dielectrics.	06 Hrs
4	**Crystal Structure:** Fundamental concepts, Crystal systems Cubic structure: Number of atoms, coordination number, packing fraction, Atomic radius, Miller indices, the relation between 'ρ' and 'a', Nuclear Physics: Nuclear properties Introduction to mass defect; packing fraction, Nuclear reaction: Q value of Nuclear reaction, Radioactivity – properties of α, β, and γ rays, GM Counter.	06 Hrs
5	**Physics of Advanced Materials:** Types of magnetic materials, ferrites and garnets, magnetic domain and hysteresis curve, Semiconductors, conductivity of semiconductors, Hall Effect Superconductors: definition – Meissner effect – type I & II superconductors, Nanomaterials: introduction and properties –	08 Hrs

synthesis: top-down and bottom-up approach, Introduction to SCADA, XRD, FESEM, VSM, and applications.

Text / Reference Books:

1. Introduction to Electrodynamics –David R. Griffiths.
2. Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.
3. Optics –Ajoy Ghatak. McGraw Hill Education (India) Pvt. Ltd.
4. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt. Ltd.
5. Solid State Physics – A.J. Dekker. MacMillan India –Limited.
6. The Feynman Lectures on Physics Vol I, II, III.
7. Introduction to solid state physics – Charles Kittel. John Willey and Sons
8. Engineering Physics – M. N. Avadhanulu and P.G. Kshirsagar.S.Chand and Company LTD.
9. Engineering Physics - R K. Gaur and S. L. Gupta, DhanpatRai Publications Pvt. Ltd.; New Delhi.
10. Fundamental of Physics - Halliday and Resnik. Wiley Eastern Limited.
11. Nanotechnology: An Introduction To Synthesis, Properties, And Applications of Nanomaterials- Thomas Varghese, K. M. Balakrishna

Engineering Physics Lab (PR 2 Hrs / Week, Credit 1)

At least 08 experiments should be performed from the following list.

1. Newton's rings - Determination of radius of curvature of Plano-convex lens/wavelength of light.
2. Wedge Shaped film - Determination of thickness of thin wire.
3. Half shade Polarimeter - Determination of specific rotation of optically active material.
4. Laser - Determination of wavelength of He-Ne laser light.
5. Magnetron Tube - Determination of 'e/m' of electrons.
6. G. M. Counter - Determination of operating voltage of G.M. tube.
7. Crystal Plane – Study of planes with the help of models related to Miller Indices.
8. Hall Effect - Determination of Hall Coefficient.
9. Four Probe Method - Determination of resistivity of semiconductor.
10. Measurement of Band gap energy of Semiconductors.
11. Experiment on fiber optics.
12. B-H Curve Experiment.
13. Experiments on SCADA.

Teaching Scheme		Semester II Object Oriented Programming in C++	Examination Scheme	
TH	3	**Course Objectives:** 1. To explain the fundamental properties of C++. 2. To describe the usefulness of basic OO abstractions like class, Methods, and Interfaces. 3. To apply code reuse techniques through inheritance. 4. To apply design OO libraries for designing UI and other programmatic features.	CA	20
PR	2		MSE	20
CR	4		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Object Oriented Programming and Objects and Classes:** Need of object-oriented programming, The object-oriented approach, Characteristics of object-oriented languages, class, Objects as data types, Constructors and Destructor, Objects as function arguments, Returning objects.	07 Hrs
2	**Operator Overloading and Type Conversion:** Operator functions, Using Overloaded operators (Unary and Binary), Global Operator function, Friend Functions, Friend Classes, Overloading Subscript operator, Overloading Shift operator for I/O. Type Conversion for classes: Conversion Function, Conversion Constructors.	07 Hrs
3	**Polymorphism:** Types of Polymorphism, Virtual functions, Dynamic binding, and pure virtual functions, Friend functions, this pointer.	07 Hrs
4	**Inheritance:** Derived Classes, Member access, Constructing and Destructing Derived classes, Inheritance Types: Single, Multilevel, Multiple, Hierarchical, and Hybrid Inheritance. Abstract Classes, Constructors in Derived Classes.	07 Hrs
5	**Working with Files and Exception Handling:** Classes for File Streaming Operations, Opening and Closing Files, Detecting End-of-File, File Modes, File Pointer, Sequential Input and Output Operations, Updating a File, Error Handling during File Operations. Basic of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, and Specifying Exception.	07 Hrs

Text Books:

1. E. Balagurusamy, Object Oriented Programming with C++, McGraw-Hill Publication, 6th Edition, 2013.
2. Dr. B. B. Meshram, Object Oriented Paradigms with C++ Beginners Guide for C and C++, SPD Publication, 1st Edition, 2016.

3. Rajesh R. Shukla, Object-Oriented Programming in C++, Wiley India Publication, 1st Edition, 2008.

Reference Books:

1. Robert Lafore, Object Oriented Programming in C++, Sams Publishing, 4th Edition, 2001.
2. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Publication, 4th Edition, 2013.
3. P. J. Deitel, H. M. Deitel, C++ How to Program, PHI Publication, 9th Edition, 2012.
4. John Hubbard, Programming with C++, Schaum's Outlines, McGraw-Hill Publication, 2nd Edition, 2000.
5. Nicolai M. Josuttis, Object-Oriented Programming in C++, Wiley Publication, 1st Edition, 2002.

Object Oriented Programming Lab (2 Hrs/Week, Credit 1)

List of Experiments:

1. Programs on Operators, Arithmetic Promotion, Method Calling.
2. Programs on dealing with Arrays.
3. Programs on Classes: String and Math.
4. Programs on Inheritance.
5. Programs on Polymorphism.
6. Programs on Garbage collection, packaging, access Modifiers, and static and abstract modifiers.
7. Programs on Interfaces block initializers, final Modifiers, and static and dynamic binding.
8. Programs on file handling and stream manipulation.
9. Programs on Dynamic Polymorphism.
10. Programs on Dynamic Memory Management.
11. Programs on Exception Handling.

Teaching Scheme		Semester II Web Site Development and MS Office	Examination Scheme	
TH	1	**Course Objectives:** 1. To design static websites through basic HTML and CSS. 2. To apply to MS Office for office automation work. 3. To be able to create and share presentations. 4. To be able to manage and store data in a spreadsheet.	CA	60
PR	2		MSE	-
CR	2		ESE	40

COURSE CONTENT

Unit No.	Topic	Hours
1	**Web Site development Essentials:** Overview of Web Design Concepts, Web Project Management Fundamentals, Web Site Development Process, HTML and the Evolution of Markup languages, HTML basic tags, Web Page Layout, and Elements, Create Hyperlinks, Create Tables, Create Web Forms, Image Inserting Techniques, Create Frames, GUI HTML Editors, Site Content and Metadata.	07 Hrs
2	**Cascading Style Sheets:** Cascading Style Sheets for Web page design, Creating CSS rules, Format Text with CSS, Use of CSS Selectors, Embed Style Sheets, and Attach External Style Sheets, Using CSS with Tables: Insert and Styling Tables, Import Table Data, Style Tables with CSS, Sort Data in Table.	06 Hrs
3	**Working with Word Document:** Text Basics, Text Formatting, and saving files, Working with Objects, Header & Footers, Bullet and Numbered lists, Tables, Style and Content, Merging Documents.	06 Hrs
4	**Working with Sheet:** Introduction to the workbook, Formatting workbook, Perform Calculations with Functions, Sort and Filter Data, Create Effective Charts to Present Data Visually, Protecting and Sharing the workbook, Use Macros to Automate Tasks.	07 Hrs
5	**Working with Presentation:** Setting Up PowerPoint Environment, Creating slides and applying themes, Working with bullets and numbering, Working with Objects, Hyperlinks, and Action Buttons, Working With Movies and Sounds, Using SmartArt and Tables, Animation and Slide Transition, Using slide Master, Slide show option. **Text Books:** 1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, Ajax, PHP, and jQuery, 2nd Edition. (English, Paperback, DT Editorial Services).	07 Hrs

Reference Books:

1. Robin Nixon, Learning PHP, MySQL & JavaScript with j Query, CSS & HTML5 Paperback by O'reilly Pub.
2. E. Robson, E. Freeman, Head First HTML & CSS, O‘Reilly Media, 2nd Edition, 2012.

Teaching Scheme		Semester II Data Science with Python	Examination Scheme	
TH	1	**Course Objectives:**	CA	60
PR	2	1. To apply the basic Python constructs for modeling data science problems.	MSE	-
CR	2	2. To apply Python for data analysis purposes. 3. To apply Python for data visualization purposes.	ESE	40

COURSE CONTENT

Unit No.	Topic	Hours
1	**Basics of Python:** Introduction Python development tools Colab/Spyder/, IDLE, Setting working Directory, Creating and saving a script file, File execution, clearing console, removing variables from environment, clearing environment Commenting script files, Variable creation, Arithmetic, and logical operators, Data types and associated operations.	06 Hrs
2	**Control Structures:** if-else family, for loop, for loop with if break, while loop, Functions.	06 Hrs
3	**Data Structures:** Lists, Tuples, Dictionary, Sets, Numpy, Array, Matrix and associated operations, Linear algebra and related operations.	06 Hrs
4	Pandas data frame and data frame related operations on a dataset Reading files, Exploratory data analysis, Data preparation and preprocessing, Data visualization using matplotlib and seaborn libraries Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot. **Case Study Regression:** Predicting the price of pre-owned cars, Classification Classifying personal income.	07 Hrs
5	Introduction to data analysis libraries such as ScikitLearn, and TensorFlow.	04 Hrs

Text Books:

1. Introduction to linear algebra - by Gilbert Strang.
2. Applied statistics and probability for engineers – by Douglas Ontgomery.
3. Mastering Python for data science, Samir Madhavan.

Data Science with Python Lab (2 Hrs/Week, Credit 1)

List of Experiments:

Python:

1. Write a program to purposefully raise Indentation Error and Correct it.
2. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) .
3. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10.
4. Write a program using a for loop that loops over a sequence.
5. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
6. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
7. Write a program combine_lists that combines these lists into a dictionary.
8. Write a program to compute the number of characters, words and lines in a file.
9. Find mean, median, mode for the given set of numbers in a list.
10. Write a function reverse to reverse a list. Without using the reverse function.

Data Science:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays.
3. Working with Pandas data frames.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
    a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
    b. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
    a. Normal curves
    b. Density and contour plots
    c. Correlation and scatter plots
    d. Histograms
    e. Three dimensional plotting
7. Visualizing Geographic Data with Basemap.

Teaching Scheme		Semester II Hindustani Music	Examination Scheme	
TH	-	**Course Objectives:**	CA	60
PR	2	1. To appreciate the diversity and uniqueness in Hindusthani Music 2. Understanding Raga Concepts and Classification. 3. Study of Different Musical Instruments. 4. To explore the Principles of Tala and Laya.	MSE	-
CR	1		ESE	40

COURSE CONTENT

Unit No.	Topic	Hours
1	Hindustani Music - A World of Colour, Romance, and History, Classical or Shastriya – What's in a Name!, Dhrupad, Khayal and Instrumental Music – A Bird's-eye View. Hindustani Music as Raga Sangeet, The Textual Tradition, Swara and Shruti: Tone and Microtone, Swara and Shruti in the Textual Tradition. Tanpura – The King of Overtones, Entering the World of Raga – Raga and Swara, The World of Raga – 2: Strong and Weak Notes, The World of Raga – 3: Ornament, The World of Raga – 4: Paths of a Raga, Raga and Time Association	05 Hrs
2	Raga Lakshana or Features of Raga, Defining Raga, Classification of Ragas – the Mela or Thaat System, Classification of Ragas – the Raagaanga System, Classification of Ragas – the Raga Ragini system. Extending the Raga Corpus – Winds from the South, Extending the Raga Corpus – Jod Ragas, Principles of Time in Hindustani Music – Tala and Laya, Some Aspects of Tala and a Few Important Tala-s, Tabla as Keeper of Tala in Khayal, Khayal-A Compositional Form, Some Contemporary Composers of Khayal.	06 Hrs
3	The Vilambit Khayal Improvisation in Khayal: Elements of Raga Vistaar., The Eight Limbs of Ashtanga of Khayal and the nature of Tabla accompaniment., A Typical Khayal Presentation, Raga Profiles as Captured in Bandish Gharanas of Hindustani Music – Introduction Gharanas of Hindustani Music – Early Masters Gharanas of Hindustani Music – Twentieth Century masters Gharanas of Hindustani Music – Melodic accompaniment in Khayal The Harmonium as a solo and accompanying instrument.	06 Hrs
4	Dhrupad: style and structure, alaap, compositional forms, song texts The Enchanting World of Thumri	07 Hrs

Instrumental Music – an Introduction The Sarod: A Lecture demonstration by Pt Suresh Vyas.

The Sitar: A Lecture demonstration by Dr Supriya Shah

The Art of Tabla: Guest Lectures by Dr Aneesh Pradhan

Bhatkhande and Paluskar - The 20th Century Reformers of Hindustani Music.

Hindustani Music in a World of Click-baits and a Million Views.

Text / Reference Books:

1. Music Contexts: A Concise Dictionary of Hindustani Music by Ashok Ranade, Bibliophile South Asia, 2006
2. Keywords and Concepts: Hindustani Classical Music by Ashok Ranade, Promilla, 2012
3. Music In India: The Classical Traditions – Bonnie C. Wade, Manohar Publishers, and Distributors, revised edition 2021
4. Lost world of Hindustani Music by Kumar Prasad Mukherjee, Penguin India, 2006 Sources on the internet:
5. https://www.swarganga.org/ - for brief discussions on a range of topics in Hindustani Music.
6. www.parrikar.org – contains curated raga clips and raga descriptions
7. Category: Hindustani music terminology - Wikipedia
8. https://mohannadkarni.org includes concert reviews, musician profiles
9. Pillars of Hindustani music: Devadhara, Bī. Āra: Free Download, Borrow, and Streaming: Internet Archive
10. Microsoft Word - Richard Widdess - Raga March 06.doc (soas.ac.uk)
11. For guided listening:
    a. Aneesh Pradhan's articles on Scroll.in: Aneesh Pradhan | Scroll. in
    b. Curated exhibits on Google Arts and Culture: Archive of Indian Music, Bangalore, India — Google Arts & Culture and Baithak Foundation, Pune, India — Google Arts & Culture.

Teaching Scheme		Exit Course Mobile Application Development for iOS Devices	Examination Scheme	
TH	1	**Course Objectives:** 1. To facilitate students to understand iOs SDK. 2. To help students to gain a basic understanding of iOs application development. 3. To inculcate working knowledge of the iOS Studio development tool.	CA	60
PR	6		MSE	40
CR	4		ESE	-

COURSE CONTENT

Unit No	Topic	Hours
1	Swift (Constants and Variables, Data Types, Operators, Control Flow), Xcode and Xcode Playgrounds, Interface Builder, Using API Reference Documentation.	06 Hrs
2	Swift (Strings, Functions, Structures, Classes, Collections, Loops), Controls, Events, Views, Images, View Controllers, Stack Views, AutoLayout	06 Hrs
3	Swift (Optionals, Type Casting, Guard, Scope, Enumerations), Segues, Navigation, Tab Bars, View Controller Life Cycle	06 Hrs
4	Swift (Protocols), App Lifecycle, Model-View-Controller, Scroll Views, Table Views, Simple Data Persistence, System-Provided View Controllers	06 Hrs
5	Swift (Closures, Extensions), UI Animation, HTTP and URL fetching, JSON Decoding, Concurrency AR Apps (3D Scenes, Detecting Planes, User Interactions, Image Recognition)	06 Hrs

Reference Books:

1. Vandad Nahavandipoor, *iOS 10 Swift Programming Cookbook*, O'Reilly Media, 1st Edition, 2015.
2. Craig Clayton, *iOS 10 Programming for Beginners*, Packt Publishing, 1st Edition, 2016.
3. Dan Pilone, Tracey Pilone, *Head First iPhone and iPad Development*, O'Reilly Media, 3rd Edition, 2013.

Teaching Scheme		Exit Course Mobile Application Development for Android Devices	Examination Scheme	
TH	1	**Course Objectives:** 1. To facilitate students to understand android SDK. 2. To help students to gain a basic understanding of Android application development. 3. To inculcate working knowledge of the Android Studio development tool.	CA	60
PR	6		MSE	40
CR	4		ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Android:** The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.	02 Hrs
2	**Android Application Design Essentials:** Anatomy of an Android application, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	02 Hrs
3	**Android User Interface Design Essentials:** User Interface Screen Elements, Designing User Interfaces with Layouts, Drawing, and Working with Animation.	02 Hrs
4	Testing Android applications, Publishing Android applications, Using Android preferences, Managing Application resources in a hierarchy, and working with different types of resources.	02 Hrs
5	**Using Common Android APIs:** Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Applications to the World.	02 Hrs

Text Book:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development," Pearson Education, 2nd ed. (2011)

Reference Book:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd.
2. Mark L Murphy, "Beginning Android," Wiley India Pvt Ltd.
3. Barry Burd; Android Application Development All in one for Dummies, Edition: I.

List of Experiments

1. Install Android Studio and Run Hello World
2. First Interactive UI
3. Using different Layouts
4. Working with Textview Elements
5. Create and Start Activities
6. Activity Lifecycle and Saving State
7. Using the Debugger
8. User Input Controls
9. Menus
10. Screen Navigation Using the App Bar and Tabs
11. Create a RecyclerView
12. Drawables, Themes, and Styles
13. Supporting landscape, multiple screen sizes
14. Create an AsyncTask
15. BroadcastReceiver
16. Transferring data efficiently (Job Scheduler)
17. Querying the SQLite database and the basics of SQLite and MySQL
18. Adding, Updating, and Deleting Content in APP using SQLite Database
19. Use a loader with a content provider
20. Send Data to the Server using PHP and MySQL
21. Publish Your App
22. Project

Teaching Scheme		Exit Course Drone Technology	Examination Scheme	
TH	1	**Course Objectives:**	CA	60
PR	6	1. To understand the basics of drone concepts. 2. To learn and understand the fundamentals of drone design, fabrication, and programming. 3. To impart knowledge of flying and operation of drones. 4. To know about the various applications of drones. 5. To understand the safety risks and guidelines of flying safely.	MSE	40
CR	4		ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Drones:** Definition and history of drones, Types of drones and their applications, Drone components and terminology, Regulations and Guidelines for drone usage.	02 Hrs
2	**Drone Design and Assembly:** Design considerations for drone airframe and propulsion systems, Selecting and assembling drone components such as motors, batteries, flight controllers, cameras, Basic wiring, and soldering techniques.	02 Hrs
3	**Drone Motors and ESC:** Working, Types: Brush and Brushless Motors, motor sizing and identification, mounting patterns, thread size, Thrust to Weight ratio, KV ratings, advanced motor selection, Electronic Speed Controller (ESC).	02 Hrs
4	**Flight Mechanics and Dynamics:** Basic principles of flight mechanics, flight controller board, Selection of drone controller with example, Factors affecting drone flight performance and efficiency.	02 Hrs
5	**Applications of Drone:** Overview of commercial and industrial drone applications, Case studies and examples of successful drone deployments, GPS-based navigation systems, Drone Camera Systems, Agro application, Drone Delivery, Future trends and developments in the drone industry.	02 Hrs

Text Books:

1. M. LaFay, Building Drones for Dummies, John Wiley & Sons, Inc., n.d.
2. E. Tooley, Practical Drones: Building, Programming, and Applications, Apress, 2021.
3. D. Levy, Drone Programming: A Guide to Code Your Own Drones, Packt Publishing, n.d.
4. S. K. Kopparthy, Drone Technology: Theory and Practice, Springer, 2020.
5. P. Horowitz and W. Hill, The Art of Electronics, Cambridge University Press, 2015.
6. K. Sundar and R. V. Rajakumar, Multicopters: Principles and Applications, Springer, 2021

Reference Books:

1. D. Saxby, Drone Aerial Photography and Video: Techniques and Stories from the Field, Cengage Learning, 2018.
2. D. McLeod, Getting Started with Drone: How to Build, Fly, and Program Your Own Drone, Apress, 2019.
3. M. A. Banks, Building and Flying Electric Model Aircraft, O'Reilly Media, Inc., 2014.
4. G. C. Camara Leal, Flying Robots: An Introduction to Autonomous Aerospace Systems, Springer, 2017.

Drone Technology Lab

List of Experiments:

1. Study of Drone Frame
2. Study of Motor
3. Study of ESC
4. Study of Flight Controller
5. Learn Soldering Techniques
6. Assembling Drone
7. Drone Flight Control

Teaching Scheme		Exit Course Entrepreneurship: Startup	Examination Scheme	
TH	1	**Course Objectives:**	CA	60
PR	6	1. To analyze various techniques to develop a product prototype. 2. Conduct effective interviews with potential customers to develop your customer personas.	MSE	40
CR	4	3. To create and describe a value proposition for a specific product. 4. To develop a go-to-market (GTM) plan, and determine key metrics, such as customer acquisition costs (CACs). 5. To present a viable profit model for a specific product. 6. To apply the four-step entrepreneurship framework to a final capstone project. 7. To learn Entrepreneurship best practices, and avoid common pitfalls.	ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	The Challenge of the Future, Party Like it's 1999? Value Systems, The Last Mover Advantage.	05 Hrs
2	The Mechanics of Mafia, Thiel's Law, Follow The Money, The Pitch.	06 Hrs
3	If You Build It, Will They Come? After Web 2.0, Secrets, War and Peace.	02 Hrs
4	You Are Not A Lottery Ticket, Seeing Green, Back to the Future, Decoding Ourselves.	07 Hrs
5	Deep Thought, Founder as Victim, Founder as God, Stagnation or singularity?	04 Hrs

Text Books:

1. Thomas G Wong, Introduction to Classical and Quantum Computing, Rooted Grove, Omaha, Nebraska, 2022
2. Micel Nielson, Quantum Computation and Quantum information, Cambridge, 2010

Semester - III

Teaching Scheme		Semester III Engineering Mathematics - III	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction, Vectors in R^n, Vector Addition and Scalar Multiplication, Dot (Inner) Product, Located Vectors, Hyperplanes, Lines, Curves in R^n, Vectors in R^3 (Spatial Vectors), ijk Notation, Complex Numbers, Vectors in C^n.	05 Hrs
2	Introduction, Matrix Addition and Scalar Multiplication, Summation Symbol, Matrix Multiplication, Transpose of a Matrix, Square Matrices, Powers of Matrices, Polynomials in Matrices, Invertible (Nonsingular) Matrices, Special Types of Square Matrices, Complex Matrices, Block Matrices.	06 Hrs
3	Introduction, Basic Definitions, Solutions, Equivalent Systems, Elementary Operations, Small Square Systems of Linear Equations, Systems in Triangular and Echelon Forms, Gaussian Elimination, Echelon Matrices, Row Canonical Form, Row Equivalence, Gaussian Elimination, Matrix Formulation, Matrix Equation of System of Linear Equations, Systems of Linear Equations and Linear Combinations of Vectors, Homogeneous Systems of Linear Equations, Elementary Matrices, LU Decomposition. Applications: Linear Programming, Fourier series: Linear Algebra for Functions, Computer Graphics, Linear Algebra for Cryptography.	07 Hrs
4	**Determinants:** Introduction, Determinants of Orders 1 and 2, Determinants of Order 3, Permutations, Determinants of Arbitrary Order, Properties of Determinants, Minors and Cofactors, Evaluation of Determinants, Classical Adjoint, Applications to Linear Equations, Cramer‘s Rule, Submatrices, Minors, Principal Minors, Block Matrices and Determinants, Determinants and Volume, Determinant of a Linear Operator, Multilinearity and Determinants.	07 Hrs
5	Diagonalization Introduction, Polynomials of Matrices, Characteristic Polynomial, Cayley–Hamilton Theorem, Diagonalization, Eigenvalues and Eigenvectors, Computing Eigenvalues and Eigenvectors, Diagonalizing Matrices, Diagonalizing Real Symmetric Matrices and Quadratic Forms, Minimal Polynomial, Characteristic and Minimal Polynomials of Block Matrices. Applications: Graphs and Networks, Matrices in Engineering, Markov Matrices, Population, and Economics.	07 Hrs

Text Books:

1. Linear Algebra, Seymour Lipschutz, Schaum's outlines, 4th Edition, McGraw-Hill Publication.

Reference Books:

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Wellesley - Cambridge Press.
2. K. Hoffman and R. Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India, 2005.
3. M. Artin, Algebra, Prentice-Hall of India, 2005.

Teaching Scheme		Semester III Data Structures and Algorithms	Examination Scheme	
TH	3		CA	20
PR	2		MSE	20
CR	4		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of algorithm, program, analyzing programs. **Arrays and Hash Tables:** Concept of sequential organization, linear and non-linear data structure, storage representation, array processing sparse matrices, transpose of sparse matrices, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.	06 Hrs
2	**Stacks and Queues:** Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.	06 Hrs
3	**Linked Lists:** Concept of linked organization, singly and doubly linked list and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.	06 Hrs
4	**Trees and Graphs:** Basic terminology, binary trees and its representation, insertion and deletion of nodes in binary tree, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees, Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.	07 Hrs
5	**Searching and Sorting:** Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion and searching. Insertion sort, selection sort, radix sort, File handling.	07 Hrs

Reference Books:

1. Horowitz and Sahani, Fundamentals of Data Structures, Universities Press, 2nd Edition, 2008.
2. Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition, 2002.
3. Venkatesan & Rose, Data Structures, Wiley Publication, 1st Edition, 2015.
4. Goodrich & Tamassia, Data Structure & Algorithm in C++, Wiley Publication, 2nd Edition, 2011.

5. R. G. Dromey, How to Solve it by Computer, 2nd Impression, Pearson Education.
6. Kyle Loudon, Mastering Algorithms with C: Useful Techniques from Sorting to Encryption, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, Data structures and algorithms analysis in C++, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, Data Structures, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, Data Structure using C and C++, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, Introduction to Data Structures, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, A Simplified Approach To Data Structure, SPD Publication, 1st Edition, 2014.

Teaching Scheme		Semester III Computer Architecture and Organization	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction:** Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.	07 Hrs
2	**Instruction Sets:** Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.	07 Hrs
3	**Computer Arithmetic:** The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.	08 Hrs
4	**Memory Organization** **Internal Memory:** Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems. **External Memory:** Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.	08 Hrs
5	**Control Unit and Input / Output Organization** **Control Unit Operation:** Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Microinstruction sequencing, Microinstruction execution, Applications of micro-programming. **Input / Output Organization:** External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface. **Instruction Pipe-lining and Parallel processing:** Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.	08 Hrs

Text Books:

1. William Stalling, Computer Organization and Architecture: Designing for Performance, Prentice Hall Publication, 8th Edition, 2009.

Reference Books:

1. Hayes, Computer Architecture and Organization, McGraw-Hill Publication, 3rd Edition, 2012.

2. Zaky, Computer Organization, McGraw-Hill Publication, 5th Edition, 2011.
3. Hennessy and Patterson, Computer Architecture: A Quantitative Approach, Morgan and Kaufmann Publication, 4th Edition, 2007.
4. Morris Mano, Computer System Architecture, Pearson Education India, 3rd Edition, 2007.
5. Mostafa Abd-El-Barr, Hesham El-Rewini, Fundamentals of Computer Organization and Architecture, Wiley Publication, 1st Edition, 2004.
6. Miles J. Murdocca, Vincent P. Heuring, Computer Architecture and Organization: An Integrated Approach, Wiley Publication, 1st Edition, 2007.
7. Sajjan G. Shiva, Computer Organization: Design, and Architecture, CRC Press, 5th Edition, 2013.

Teaching Scheme		Semester III Data Communication	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction, Network Models, Introduction to Physical Layer: Data and Signals: Analog and digital data, Analog and digital signals, Periodic and non-periodic signals, Sine wave, Parameters of sine wave, Time and frequency domain, Composite signals, Bandwidth, Digital signal-bit rate, Baseband and broadband transmission, Transmission impairments, Nyquist bit rate, Shannon capacity, Performance: Throughput, Latency, Bandwidth-delay product, Jitter.	05 Hrs
2	Analog Transmission: Digital to analog conversion- Amplitude shift keying, Frequency shift keying, Phase shift keying, Quadrature amplitude Modulation, Analog to analog Conversion - Amplitude modulation, Frequency modulation, Phase modulation. Multiplexing: Need of multiplexing, Introduction, Multiplexer and demultiplexer, Frequency division multiplexing, Wavelength division multiplexing, Time division multiplexing – Statistical TDM, Synchronous TDM, Data rate management in TDM.	06 Hrs
3	Digital Transmission: Digital to digital conversion, Signals element, Data element, Signal rate, Data rate, DC-component, Self synchronization, Line coding schemes - NRZ, NRZI, Bipolar AMI, Pseudoternary, Manchester, Differential manchester; Block coding schemes - 4B/5B, 8B/10B, Scrambling – HDB3, B8ZS, Analog to digital conversion: Pulse code modulation, Delta modulation, Transmission modes- serial and parallel transmission.	07 Hrs
4	Transmission Media: Guided Media – Twisted pair cable, Coaxial cable, Fiber optic cable, Performance of each, Unguided media – Radio waves, Microwaves, Infrared. Introduction to fiber optics: Nature of light, Fiber characteristics, Sources and detectors, Connectors and splices.	07 Hrs
5	Error Detection and Correction: Types of errors, Redundancy, Detection versus correction, Forward error correction and retransmission, Modular arithmetic, Block Coding: error detection, error correction, Hamming distance, Minimum hamming distance, Linear block codes, Cyclic Codes: Cyclic Redundancy check, Hardware implementation, Polynomials, Cyclic code analysis, Checksum: Concept, One's component, Internet checksum.	07 Hrs

Text / Reference Books:

1. Schweber, Data Communication, 1st Edition, McGraw Hill Publication, 2009.

2. Behrouz Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw Hill Publication, 2013.
3. Stalling, Data Communications and Computer Network, PHI Publication.

Teaching Scheme		Semester III Quantum Computing	Examination Scheme	
TH	2	**Course Objectives:**	CA	20
PR	-	1. To review classical computing fundamentals particularly its limitations.	MSE	20
CR	2	2. To Define quantum computing and its key principles.	ESE	60
		3. To explain the fundamental differences between classical and quantum computing paradigms.		
		4. To introduce basic principles of quantum mechanics relevant to quantum computing.		
		5. To define basic concepts such as superposition, entanglement, and quantum measurement.		
		6. Introduce quantum gates and their operations.		
		7. Discuss quantum circuits and how they are constructed.		
		8. Introduce different quantum computing models and architectures.		
		9. Discuss challenges facing quantum computing, such as decoherence and error correction.		
		10. To provide Hands-On Quantum Programming:		
		a. Provide practical experience with quantum Programming languages such as Qiskit or Quipper.		
		b. Implement basic quantum algorithms and simulate their behavior on classical computers.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Classical Information and Computation:** Bits, Coins, Encoding Information, Physical Bits, Binary, ASCII,Logic Gates, Single-Bit Gates, Two-Bit Gates, Logic Gates as Physical Circuits, Multiple Gates,Universal Gates , Adders and Verilog, Adding Binary Numbers by Hand, Half Adder, Full Adder, Ripple-Carry Adder, Ripple-Carry with Full Adders , Circuit Complexity, Circuit Simplification and Boolean Algebra, Order of Operations, Association, Commutativity, and Distribution, Identities Involving Zero and One, Single-Variable Identities, Two-Variable Identities and De Morgan's Laws, Circuit Simplification, Reversible Logic Gates, Reversible Gates, Irreversible Gates	05 Hrs
2	**One Quantum Bit:** qubit touchdown: A quantum computing board game, Superposition, measurement, Bloch sphere mapping, physical qubits, quantum gates, quantum circuits. **Linear Algebra:** Quantum states, inner products, quantum gates, outer products	06 Hrs

3	**Multiple quantum bits:** Entaglion, States and Measurement, Entanglement, Quantum gates, quantum adders, Universal quantum gates, quantum error correction. **Quantum Programming:** IBM Quantum Experience, Quantum Assembly Language, Qiskit, Other Quantum Programming language.	07 Hrs
4	**Entanglement and Quantum Protocols:** MEasurements, Bell Inequalities, Monogamy of Entanglement, Superdense Coding, Quantum Teleportation, Quantum Key distribution	07 Hrs
5	**Quantum Algorithms:** Circuit vs Query Complexity, Parity, Constant vs Balanced functions, secret dot string, brute force searching, discrete fourier transform, phase or eigenvalue estimation, period of modular exponentiation, factoring.	07 Hrs

Text Books:

1. Thomas G Wong, Introduction to Classical and Quantum Computing, Rooted Grove, Omaha, Nebraska, 2022.
2. Micel Nielson, Quantum Computation and Quantum information, Cambridge, 2010

Teaching Scheme		Semester III Python Programming	Examination Scheme	
TH	2		CA	20
PR	-		MSE	20
CR	2		ESE	60

Introduction to Python Programming:
History of Python, Python Features, Local Environment Setup, Installing, Python, setting up path, Python Syntax, Keywords, Variables.

Data Types: Scalar Types, Sequence Type, Mapping Type, Set Types

Mutable Types: List, Dictionary, Set, Immutable Types: Numbers, String, Tuple

Operators: Arithmetic, Assignment, Comparison, Logical, Identity, Membership, Bitwise, Basic of String- String operations

Conditional & Control Structures: if, if..else, if-elif and nested if

Loops: for, while, nested loops, Break and Continue Statement

Functions & Recursion: Function calls, Type Conversion and Coercion, Math Functions, Adding new Function, Parameters and Argument, Recursion and its use, Lambda Functions and Anonymous Functions in Python, Python decorator (with -@Symbol - Chaining - Parameters)

Objects & Classes: Overview of OOP Terminology, Creating Classes, Creating Instance Objects, Destroying Objects, Access Modifiers, Inheritance, Polymorphism, Operator Overloading, Abstract Classes, Overriding Methods

Exceptions Handling, Python integrate with SQL: File Operations – Iterators - Exception handling - Regular Expressions PIP: Introduction - Installing Packages via PIP -Using Python Packages. My SQL Connectivity, Installing MySQL - Connector, Establishing Connection, Creating Cursor Object, Create database

Teaching Scheme		Semester III Business Economics	Examination Scheme	
TH	2		CA	20
PR	-		MSE	20
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**The Scope and Method of Economics:** Why Study Economics?, Economics Practice, The Scope of Economics, The Diverse Fields of Economics, The Method of Economics, Economic Policy.	05 Hrs
2	**The Economic Problem: Scarcity and Choice** Scarcity, Choice, and Opportunity, Scarcity and Choice in a One-Person Economy, Scarcity and Choice in an Economy of Two or More, The Production Possibility Frontier, The Economic Problem, Economic Systems and the Role of Government, Command Economies, Laissez-Faire Economies: The Free Market Mixed Systems, Markets, and Governments	06 Hrs
3	**Demand, Supply, and Market Equilibrium** Firms and Households: The Basic Decision-Making Units, Input Markets and Output Markets: The Circular Flow, Demand in Product/Output Markets, Changes in Quantity Demanded versus Changes in Demand, Price and Quantity Demanded: The Law of Demand, Other Determinants of Household Demand, Shift of Demand versus Movement Along the Demand Curve, From Household Demand to Market Demand, Supply in Product/Output Markets, Price and Quantity Supplied: The Law of Supply Other Determinants of Supply, Shift of Supply versus Movement Along the Supply Curve, From Individual Supply to Market Supply, Market Equilibrium: Excess Demand, Excess Supply, Changes in Equilibrium.	07 Hrs
4	**Elasticity:** Price Elasticity of Demand, Slope and Elasticity, Types of Elasticity, Calculating Elasticities, Calculating Percentage Changes, Elasticity Is a Ratio of Percentages, The Midpoint Formula, Elasticity Changes Along a Straight-Line Demand Curve, Elasticity and Total Revenue, The Determinants of Demand Elasticity, Availability of Substitutes, The Importance of Being Unimportant, The Time Dimension, Other Important Elasticities, Income Elasticity of Demand, Cross-Price Elasticity of Demand, Elasticity of Supply.	07 Hrs
5	**Household Behavior and Consumer Choice:** Household Choice in Output Markets, The Determinants of Household Demand, The Budget Constraint, The Equation of the Budget Constraint, The Basis of Choice: Utility, Diminishing Marginal Utility, Allocating Income to Maximize Utility, The Utility-Maximizing Rule, Diminishing Marginal Utility and Downward-Sloping Demand, Income and Substitution Effects, The Income Effect, The Substitution Effect, Household Choice in Input Markets, The Labor Supply Decision, The	07 Hrs

Price of Leisure, Income and Substitution Effects of a Wage Change, Saving and Borrowing: Present versus Future Consumption.

Text Books:

1. Karl E. Case and Ray C. Fair, Principles of Economics, Pearson Education Inc., 10th Edition, 2012.

Teaching Scheme		Semester III IDEA Lab	Examination Scheme	
TH	-	**Course Objectives:**	CA	40
PR	2		MSE	-
CR	1		ESE	60

List of Experiments:

1. Documentation using Doxygen, Google Docs.
2. Various computational operations (Data Analytics) through Google Sheet
3. Version control tools - GIT and GitHub.
4. Introduction to various programming IDEs used for C / C++ / Java.
5. Introduction to Jupyter Notebook.
6. Introduction to Google Colab Platform.
7. Introduction to various online diagram drawing platforms.
8. Introduction to online LaTex tools platforms.

Teaching Scheme		Semester III Universal Human Values - II	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	05 Hrs
2	Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	05 Hrs
3	Harmony in the Family and Society: Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order	04 Hrs
4	Harmony in the Nature (Existence): Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	05 Hrs
5	Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	05 Hrs

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Teaching Scheme		Semester III Life of Chhatrapati Shivaji Maharaj	Examination Scheme	
TH	1		CA	50
PR	-		MSE	-
CR	1		ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	Shivaji Maharaj as a Great Conqueror, Master Strategist and innovator in Military Tactics Guerrilla Warfare (Ganimi Kava), Fortress Strategy, Avoidance of Direct Confrontation, Diplomacy and Alliances, Naval Power.	05 Hrs
2	Shivaji Maharaj's Management and leadership strategies, Architecture and metallurgy of Raigad Fort, Use of Light Cavalry, Intelligence Network, Asymmetric Warfare, Logistics and Supply Chains, Fortifications and Military Architecture	05 Hrs
3	Shivaji Maharaj’s views about Women's rights, their dignity and religious views. His views on Democracy & Nationalism	05 Hrs

Teaching Scheme		Semester III Data Structures and Algorithm Laboratory	Examination Scheme	
TH	-		CA	40
PR	2		MSE	-
CR	1		ESE	60

Data Structure and Algorithm Laboratory

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement a circular queue using arrays.
5. Write a program to implement double ended queue (dequeue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that dequeue operation runs in constant time and dequeue operation runs in linear time.
9. Write programs to implement the following data structures: (a) Single linked list (b) Double linked list (c) Circular linked list
10. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O (1) time.
11. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) Find successor of a node (f) delete a node with given key.
12. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
13. Implement the following sorting algorithms: (a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort.
14. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS.

Semester - IV

Teaching Scheme		Semester IV Design and Analysis of Algorithms	Examination Scheme	
TH	3		CA	20
PR	–		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Algorithms:** Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable, Heap Sort.	07 Hrs
2	**Divide and Conquer:** Introduction, Binary Search, Merge Sort, Quick Sort, Strassen‘s Matrix Multiplication.	07 Hrs
3	**Backtracking:** Backtracking Concept, N–Queens Problem, Four–Queens Problem, Eight–Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem, Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.	07 Hrs
4	**Greedy Algorithms:** Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree, Single-Source Shortest Path Algorithm.	07 Hrs
5	**Dynamic Programming:** Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Subsequence, matrix multiplication, shortest paths: Bellman Ford, Floyd Warshall, Application of Dynamic Programming. **NP Completeness:** Introduction, the Complexity Class P, the Complexity Class NP, Polynomial-Time Reduction, the Complexity Class NP-Complete.	07 Hrs

Text Books:

1. T. Cormen, Introduction to Algorithms, PHI Publication, 4th Edition, 2022.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design – Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition,2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2nd Edition, 2016.

4. Ellise Horowitz, Sartaj Sahni, S. Rajasekaran, Fundamentals of Computer Algorithms, University Press (India) Private Ltd, 2nd Edition, 2008.
5. Sara Base, Computer algorithms: Introduction to Design and Analysis, Addison-Wesley Publication, 2nd Edition, 1988.

Teaching Scheme		Semester IV Discrete Mathematics	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Functions:** Introduction, Subjective, Injective, Bijective, inverse functions, Composition of function. **Relations:** Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Equivalence classes and partitions, Partial Ordering, Hasse Diagram, Topological Sort.	07 Hrs
2	**Combinatorics:** Applications of Recurrence Relations, Solving Linear Recurrence Relations, Generating functions.	07 Hrs
3	**Graph:** Some Special Simple Graphs, Bipartite Graphs, New Graphs from Old, Shortest path problems, Euler and Hamiltonian paths, Isomorphic graphs, Planar graphs, Connectivity, Matching Coloring.	07 Hrs
4	**Trees:** Prefix Codes, Huffman coding, Spanning trees and cut sets, Minimal spanning trees, Kruskal‘s and Prim‘s algorithms for minimal spanning trees.	07 Hrs
5	**Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields, Boolean Algebra and Boolean Ring.	07 Hrs

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.

Reference Books:

1. Lipschutz, Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009.
2. V. K. Balakrishnan, Schaum's Outline of Graph Theory, McGraw-Hill Publication, 1st Edition, 1997.
3. Eric Gossett, Discrete Mathematics with Proof, Wiley Publication, 2nd Edition, 2009.
4. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010.

5. Y. N. Singh, Discrete Mathematical Structures, Wiley Publication, 1st Edition, 2010.
6. Dr. Sukhendu Dey, Graph Theory with Applications, SPD Publication, 1st Edition, 2012.

Teaching Scheme		Semester IV Database Management Systems	Examination Scheme	
TH	3		CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, Constraints, keys, E-R Diagrams, Mapping Cardinality, Concepts of Super Key, candidate key, primary key, weak entity sets, Codd's rules, Extended ER model, Generalization, Aggregation, Reduction of an ER diagrams to tables.	10 Hrs
2	**Relational Data Model, Relational Algebra and Calculus** Structure of Relational Databases, Database Schema, Keys Relational algebra: Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs. algebra, computational capabilities.	07 Hrs
3	**Introduction to SQL** Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operators, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database. Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schema, Authorization. Advanced SQL: Assessing SQL from Programming Language, JDBC, ODBC, Embedded SQL, Functions and Procedures, Triggers,.	07 Hrs
4	**Relational Database Design and File Organization, Indexing & Hashing** Normalization: Features of good relational designs, Functional dependencies, Normal forms, First, Second, Third normal forms, BCNF, Functional Dependency Theory, Multivalued Dependencies, Fourth Normal Form, Database Design Process. File Organization, Ordered Indices, B+ tree Index files, B Tree Index File, Static Hashing, Dynamic Hashing.	07 Hrs
5	**Transaction Processing** Transaction Concept, A simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, ACID Properties, Serializability Concurrency Control Techniques: Lock based Protocols, Deadlock handling, Multiple Granularity, Time stamp-Based Protocols, Recovery System.	07 Hrs

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, Database System Concepts, McGraw-Hill Publication, 6th Edition, 2011.

Reference Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Publication, 3rd Edition, 2003.
2. Joel Murach, Murach's Oracle SQL and PL/SQL for Developers, Mike Murach & Associates, 2nd Edition, 2014.
3. Wiederhold, Database Design, McGraw-Hill Publication, 2nd Edition, 1983.
4. Navathe, Fundamentals of Database System, Addison-Wesley Publication, 6th Edition, 2012.
5. Mark L. Gillenson, Fundamentals of Database Management System, Wiley Publication, 2nd Edition, 2011.
6. Serge Abiteboul, Richard Hull, Victor Vianu, Foundations of Databases, Reprint by Addison-Wesley.

Teaching Scheme		Semester IV Numerical Methods	Examination Scheme	
TH	2		CA	20
PR	-		MSE	20
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Solution of Algebraic and Transcendental Equation: Bisection method, Method of false position, Newton‘s method and Newton-Raphson method.	07 Hrs
2	Solution of Linear Simultaneous Equation: Gauss elimination method, Gauss-Jordan method, Iterative method of solution- Jacobi iteration method, Gauss-Seidal iteration method, Relaxation method.	07 Hrs
3	Finite Differences: Forward difference operator, Backward difference operator, Central difference operator, New- ton‘s interpolation formulae, Newton‘s forward–backward-central interpolation formulae.	07 Hrs
4	Differentiation and Integration: Newton-Cortes formula, Trapezoidal rule, Simpson one–third rule, Simpson three- eighth rule.	07 Hrs
5	Numerical Solution of ODE: Picard‘s methods, Taylor series method, Euler‘s method, Modified Euler‘s method, Runge Kutta method.	07 Hrs

Text Books:

1. B. S Grewal, Higher Engineering Mathematics, 40th edition, Khanna publication.

Reference Books:

1. S. S. Shastri, Introduction to Numerical Methods, PHI publication.
2. V. Rajaraman, Computer Oriented Methods, 3rd edition, PHI publication.
3. Conte and De boor, Elementary Numerical Analysis, BPB publication.
4. E. Kreyszig, Advanced Engineering Mathematics, BPB publication.
5. Steven C Chapra, Numerical Methods for Engineers, 5th edition, McGraw Hill publication.

Teaching Scheme		Semester IV Competitive Programming	Examination Scheme	
TH	1		CA	40
PR	2		MSE	-
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction: Online Judge The Programming Challenges Robot Judge, Understanding Feedback From the Judge, Choosing Programming Languages, Reading Our Programs, Standard Input/Output, Programming Hints, Elementary Data Types. **Challenging Problems** (1) The 3n + 1 Problem (2) Minesweeper (3) The Trip, (4) LCD Display (5) Graphical Editor (6) Interpreter (7) Check the Check (8) Australian Voting	07 Hrs
2	Elementary Data Structures: Data Structures: Elementary Data Structures, Stacks, Dictionaries, Priority Queues Sets, Object Libraries, The C++ Standard Template Library, The Java java.util Package, Program Design Example: Going to War, Hitting the Dec, String Input/Output, Winning the War, Testing and Debugging. **Challenging Problems** (1) Jolly (2) Poker Hands (3) Hartals (4) Crypt Kicker (5) Stack 'em Up (6) Erd¨os Numbers (7) Contest Scoreboard (8) Yahtzee.	07 Hrs
3	Strings: Character Codes, Representing Strings, Program Design Example: Corporate Renamings, Searching for Patterns, Manipulating Strings, Completing the Merger, String Library Functions. **Challenging Problems** (1) WERTYU (2) Where's Waldorf? (3) Common Permutation (4) Crypt Kicker II (5) Automated Judge Script (6) File Fragmentation (7) Doublets (8) Fmt	07 Hrs
4	Sorting: Sorting, Sorting Applications Sorting Algorithms, Program Design Example: Rating the Field, Sorting Library Functions, Rating the Field. **Challenging Problems** (1) Vito's Family (2) Stacks of Flapjacks (3) Bridge (4) Longest Nap (5) Shoemaker's Problem (6) CDVII (7) Shell Sort (8) Football.	07 Hrs
5	Arithmetic and Algebra: Machine Arithmetic, Integer Libraries, High-Precision Integers, High-Precision Arithmetic, Numerical Bases and Conversion, Real Numbers, Dealing With Real Numbers, Fractions, Decimals, Algebra, Manipulating Polynomials, Root Finding, Logarithms, Real Mathematical Libraries. **Challenging Problems** (1) Primary Arithmetic (2) Reverse and Add (3) The Archeologist's Dilemma (4) Ones (5) A Multiplication Game (6) Polynomial Coefficients (7) The Stern-Brocot Number System (8) Pairsumonious Numbers.	07 Hrs

Combinatorics: Basic Counting Techniques, Recurrence Relations, Binomial Coefficients, Other Counting Sequences, Recursion and Induction Problems.

Text / Reference Books:

1. Steven S. Skiena Miguel A. Revilla, Programming Challenges The Programming Contest Training Manual, Springer.
2. Antti Laaksonen, Competitive Programmer‘s Handbook.
3. Steven Halim, Competitive Programming 3: The Lower Bounds of Programming Contests.
4. Gayle Lakaman Cracking the Coding Interview.
5. The Hitchhiker‘s Guide to the Programming Contests.

Teaching Scheme		Semester IV Data Structures	Examination Scheme	
TH	2		CA	20
PR	-		MSE	20
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of algorithm, program, analyzing programs. **Arrays and Hash Tables:** Concept of sequential organization, linear and non-linear data structure, storage representation, array processing sparse matrices, transpose of sparse matrices, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.	07 Hrs
2	**Stacks and Queues:** Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.	07 Hrs
3	**Linked Lists:** Concept of linked organization, singly and doubly linked list and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.	07 Hrs
4	**Trees and Graphs:** Basic terminology, binary trees and its representation, insertion and deletion of nodes in binary tree, binary search tree and its traversal, Terminology and representation of graphs using adjacency matrix, BSF, DFS.	07 Hrs
5	**Searching and Sorting –** Searching-linear and binary search methods Sorting-selection sort, bubble sort, insertion sort, quick sort, merge sort comparison of sorting and searching methods.	07 Hrs

Reference Books:

7. Horowitz and Sahani, Fundamentals of Data Structures, Universities Press, 2nd Edition, 2008.
8. Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition, 2002.
9. Venkatesan & Rose, Data Structures, Wiley Publication, 1st Edition, 2015.
10. Goodrich & Tamassia, Data Structure & Algorithm in C++, Wiley Publication, 2nd Edition, 2011.
11. R. G. Dromey, How to Solve it by Computer, 2nd Impression, Pearson Education.
12. Kyle Loudon, Mastering Algorithms with C: Useful Techniques from Sorting to Encryption, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, Data structures and algorithms analysis in C++, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, Data Structures, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, Data Structure using C and C++, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, Introduction to Data Structures, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, A Simplified Approach To Data Structure, SPD Publication, 1st Edition, 2014.

Teaching Scheme		Semester IV Principle of Management	Examination Scheme	
TH	2		CA	20
PR	-		MSE	20
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Management:** What Is Management and Why Is It Needed?, Adding Value to the Organization, Management as a System Ethics and Social Responsibilities, How the Environment Affects Managers.	07 Hrs
2	**Planning and Decision Making:** The Importance of Planning, The Components of a Strategic Plan, The Decision-Making Process.	07 Hrs
3	**Organizing, Communication and Human Resources:** Organizational Structure and Design, Communication and Information Technology, Human Resources.	07 Hrs
4	**Leadership, Motivation and Understanding Groups and Teams:** Leadership Approaches and Theories, Motivating Your Employees, Managing Work Teams.	07 Hrs
5	**Controlling and Managing Innovation and Change:** What is Control and Why Engage In It?, Measuring, Monitoring and Modifying Information, Managing Innovation and Change.	07 Hrs

Text Books:

1. Paul Hersey, Kenneth H. Blanchard, *Management of Organizational Behavior: Utilizing Human Resources*, Pearson, 2012.

Reference Books:

1. Harold Koontz, Cyril O'Donnell, *Essentials of Management*, McGraw Hill Publication, 2012.
2. L. M. Prasad, *Principles and Practice of Management*, Sultan Chand, 2012.
3. S. R. Robbins, *Organizational Behavior*, Pearson, 2013.

Teaching Scheme		Semester IV Full Stack Development Development	Examination Scheme	
TH	1		CA	40
PR	2		MSE	-
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	Bootstrap: Introduction to Bootstrap, Bootstrap Basics, Bootstrap Grids, Bootstrap Themes, Bootstrap CSS, Bootstrap JS.	07 Hrs
2	Javascripts: Introduction to JavaScript, JavaScript Language Basics, JavaScript Events, JavaScript Strings, JavaScript Type Conversion, JavaScript RegExp, JavaScript Error, JavaScript Hoisting,	07 Hrs
3	jQuery: jQuery Events, jQuery Effects, jQuery HTML, jQuery Traversing, jQuery AJAX & Misc.	07 Hrs
4	PHP & Mysql: Embedding PHP in HTML, Adding Dynamic Content, Accessing Form Variables, Storing and retrieving data, Using Arrays perform different operations, String Manipulation and Regular Expressions.	07 Hrs
5	MVC with Laravel: Laravel Installation, Working with Forms, Working with Controller, Laravel Blade Template with Bootstrap, Responses with Html, Laravel Migration, Laravel Requests, Models; Laravel Eloquent ORM, Build a Complete App in Laravel.	07 Hrs

Text / Reference Books:

1. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon.
2. Full-Stack JavaScript Development by Eric Bush.
3. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas.
4. “Laravel: Up and Running" by Matt Stauffer.
5. Title: Head First jQuery by Ryan Benedetti, Ronan Cranley, September 2011, O'Reilly Media, Inc.

Teaching Scheme		Semester IV Constitution of India	Examination Scheme	
TH	1		CA	50
PR	-		MSE	-
CR	Audit		ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction:** Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, FundamentalRights and Duties, Directive, Principles of State Policy.	05 Hrs
2	**Union Government and its Administration:** Structure of the Indian Union: Federalism, Centre- State, relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	05 Hrs
3	**State Government and its Administration** Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.	04 Hrs
4	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati Raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	05 Hrs
5	**Election Commission:** Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role andFunctioning, Institute and Bodies for the welfare of SC/ST/OBC and women.	05 Hrs

Text/Reference Books:

1. Sastry, T. S. N., (2005). India and Human rights: Reflections, Concept Publishing Company India (P Ltd.).
2. Nirmal, C.J., (1999). Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

Teaching Scheme		Semester IV Life of Bharat Ratna Dr. Babasaheb Ambedkar	Examination Scheme	
TH	1		CA	50
PR	-		MSE	-
CR	1		ESE	-

COURSE CONTENT

Unit No.	Topic	Hours
1	Introduction to the socio-political context of Ambedkar's era, British Colonialism, Indian National Movement, Caste Hierarchy, Untouchability, Social Reform Movements, Role in the Indian freedom struggle.	05 Hrs
2	Contributions to the Constitution of India, Vision for social justice and empowerment.	05 Hrs
3	Dr. Ambedkar and Marxism: An Exploration of His Thoughts on Marxism, Common ground with Marxism, Focus on class struggle, Caste vs. Caste, Primacy of Caste in Indian Society, Economic ideas and policies	05 Hrs

Teaching Scheme		Semester IV Design and Analysis of Algorithm Laboratory	Examination Scheme	
TH	-		CA	40
PR	2		MSE	-
CR	1		ESE	60

List of Experiments:

1. Implementation of Binary Search.
2. Implementation of finding maximum and minimum numbers using divide and conquer.
3. Implementation of Merge / Quick sort.
4. Implementation of Selection sort.
5. Implementation of Job Sequencing with deadlines.
6. Program for finding minimum cost Spanning Tree.
7. Implementation of single source shortest path.
8. Implementation of all pairs shortest path.
9. Program for Tree traversal techniques.
10. Program for Graph traversal technique.

Teaching Scheme		Semester IV Database Management System Laboratory	Examination Scheme	
TH	-		CA	40
PR	2		MSE	-
CR	1		ESE	60

List of Experiments:

1. Defining schema for applications.
2. Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.
3. Grouping data, aggregate functions, Oracle functions (mathematical, character functions).
4. Sub-queries, Set operations, Joins.
5. Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6. Assignment on Triggers & Cursors.
7. Normal Forms: First, Second, Third and Boyce Codd Normal Forms.
8. Assignment in Design and Implementation of Database systems or packages for applications such as office automation, hotel management, hospital management.
9. Deployment of Forms, Reports Normalization, Query Processing Algorithms in the above application project.
10. Large objects – CLOB, NCLOB, BLOB and BFILE.
11. Distributed database Management, creating web-page interfaces for database applications using servlet.

डॉ. बाबासाहेब आंबेडकर तंत्रशास्त्र विद्यापीठ, लोणेरे

इंग्रजी विभाग

उपयोजित मराठी/ व्यावहारिक मराठी अभ्यासक्रम

Course Code	Course Title	Teaching Scheme			Examination Scheme					
		L	T	P	Continuous Assessment (1)	Continuous Assessment (2)	Mid Term Test	End Semester Exam	Total	Credits
2311372AE204	उपयोजित मराठी/ व्यावहारिक मराठी	2	0	0	10	10	20	60	100	2

Course Objectives:

- मराठी भाषेचा ऐतिहासिक प्रवास, तिच्या निर्मितीतील संस्कृत, प्राकृत आणि अपभ्रंश भाषांचा प्रभाव समजून घेणे.
- मराठी लेखनाचे नियम, व्याकरण व शुद्धलेखन यांची अचूकता आत्मसात करणे.
- सर्जनशील आणि औपचारिक लेखन कौशल्ये विकसित करणे.
- भाषांतर तत्त्वे, प्रक्रिया आणि सांस्कृतिक संदर्भ यांचा विचार करून मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर करण्याचे कौशल्य प्राप्त करणे.

Course Outcomes:

- विद्यार्थी मराठी भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील.
- शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल.
- विविध प्रकारच्या लेखन शैली आत्मसात करून सृजनशील, विश्लेषणात्मक आणि औपचारिक लेखन करू शकतील.
- अचूक, स्पष्ट आणि भाषिक-सांस्कृतिक दृष्टिकोनातून योग्य भाषांतर करू शकतील.
- व्यावसायिक आणि साहित्यिक भाषांतरात प्रावीण्य मिळवू शकतील.

घटक- १. मराठीचा उगम आणि विकास

- मराठीचा उगम आणि विकास
- मराठी भाषेवर संत परंपरेचा प्रभाव- ज्ञानेश्वर, तुकाराम, नामदेव आणि एकनाथ यांच्या रचनांचा अभ्यास.
- मराठीत बखरी लेखन व इतिहासदर्शन.
- आधुनिक मराठी आणि सुधारणा चळवळी- टिळक, फुले, आणि आगरकर यांचे योगदान.

घटक- २. स्वातंत्र्यानंतरची मराठी भाषा

- महाराष्ट्र राज्य निर्मिती व मराठीचा अधिकृत दर्जा.
- डिजिटल युगातील मराठी भाषा : ब्लॉग, सोशल मीडिया आणि ई-साहित्य.
- मराठी भाषा संरक्षणासाठी उपाययोजना.
- शिक्षणव्यवस्थेतील मराठीचा वापर.
- जागतिक स्तरावर मराठी भाषेचा प्रभाव.

घटक-३. मराठी लेखनाचे नियम आणि व्याकरण

- संधि
- वाक्यप्रकार (विधानार्थी वाक्य, प्रश्नार्थी वाक्य, आज्ञार्थी वाक्य इ.)
- विरामचिन्हे आणि त्यांचे उपयोग
- शुद्धलेखन
- समानार्थी शब्द (पर्यायवाची शब्द), विरुद्धार्थी शब्द

घटक-४. लेखन कौशल्य

- लेखन कौशल्याचा परिचय- लेखन कौशल्याचे महत्त्व आणि आवश्यकता
- पत्रलेखन
- निबंध लेखन
- वृत्तलेखन (वृत्तपत्रीय लेखन)
- इतिवृत्त लेखन
- सारांश लेखन

घटक- ५. भाषांतर (मराठीतून इंग्रजी अणि इंग्रजीतून मराठी)

- भाषांतराचा मूलभूत परिचय- भाषांतराची व्याख्या आणि स्वरूप, महत्त्व आणि उपयोग, भाषांतराचे प्रकार इ.
- पारिभाषिक शब्दावली

- मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर.

संदर्भ साहित्य

1. प्रशासनिक लेखन, भाषा संचालनालय , महाराष्ट्र शासन, मुंबई १९६६
2. सुगम मराठी व्याकरण व लेखन - मो.रा. वाळंबे
3. "अनुवाद सिद्धांत आणि प्रयोग" – डॉ. भालचंद्र नेमाडे (लोकवाङ्मय गृह प्रकाशन)
4. मराठी भाषा आणि साहित्याचा इतिहास – वि.का. राजवाडे प्रकाशक : राजवाडे संशोधन मंडळ, धुळे
5. भाषांतर : सिद्धांत आणि प्रयोग – डॉ. अशोक केळकर प्रकाशक : लोकवाङ्मय गृह, मुंबई

डॉ. बाबासाहेब आंबेडकर तंत्रशास्त्र विद्यापीठ, लोणेरे

इंग्रजी विभाग

सामान्य हिंदी / व्यावहारिक हिंदी पाठ्यक्रम

Course Code	Course Title	Teaching Scheme			Examination Scheme					
		L	T	P	Continuous Assessment (1)	Continuous Assessment (2)	Mid Term Test	End Semester Exam	Total	Credits
2311372AE204	सामान्य हिंदी / व्यावहारिक हिंदी	2	0	0	10	10	20	60	100	2

पाठ्यक्रम उद्देश्य (Course Objectives):

- हिंदी भाषा के उद्भव, विकास और ऐतिहासिक प्रवृत्तियों को समझाना।
- हिंदी व्याकरण और लेखन कौशल में दक्षता प्रदान करना।
- प्रशासन, शिक्षा और संचार में हिंदी के व्यावहारिक उपयोग को स्पष्ट करना।
- अनुवाद कौशल विकसित करना, जिससे तकनीकी एवं व्यावसायिक संचार सुगम हो।

अपेक्षित परिणाम (Course Outcomes):

- विद्यार्थी हिंदी भाषा के ऐतिहासिक और आधुनिक विकास को समझेंगे।
- हिंदी व्याकरण और लेखन के नियमों में दक्षता प्राप्त करेंगे।
- व्यावसायिक, प्रशासनिक और तकनीकी लेखन में हिंदी का प्रयोग कर सकेंगे।
- अनुवाद के सिद्धांतों को सीखकर अंग्रेजी और हिंदी के बीच प्रभावी अनुवाद कर सकेंगे।

इकाई – १. हिंदी भाषा का उद्भव और स्रोत

- हिंदी भाषा की उत्पत्ति और स्वरूप
- संस्कृत, प्राकृत और अपभ्रंश से हिंदी का विकास
- हिंदी की प्रमुख बोलियाँ (ब्रज, अवधी, खड़ी बोली, भोजपुरी, राजस्थानी आदि)
- हिंदी पर फारसी, अरबी और अंग्रेज़ी भाषाओं का प्रभाव

इकाई- २. स्वातंत्र्योत्तर काल में हिंदी भाषा

- प्रशासन, शिक्षा और संचार माध्यमों में हिंदी की भूमिका
- राजभाषा के रूप में हिंदी – संवैधानिक स्थिति और व्यावहारिक उपयोग
- हिंदी का वैश्विक विस्तार और डिजिटल माध्यमों में हिंदी की उपस्थिति
- प्रशासन और संचार माध्यमों में हिंदी

इकाई- ३. हिंदी भाषा लेखन के नियम और व्याकरण

- वर्णमाला
- शब्द-भेद
- संधि
- वाक्य रचना
- वर्तनी
- उपसर्ग, प्रत्यय और शब्द निर्माण की प्रक्रिया
- विराम चिन्हों का प्रयोग
- पर्यायवाची शब्द
- विलोम शब्द

इकाई- ४. लेखन कौशल

- पत्र लेखन
- प्रतिवेदन (रिपोर्ट) लेखन
- विज्ञप्ति, नोटिस और परिपत्र लेखन

- निबंध लेखन
- सार लेखन

इकाई- ५. अनुवाद (अंग्रेजी से हिंदी और हिंदी से अंग्रेजी)

- अनुवाद : सिद्धांत और परंपरा
- अनुवाद : क्षेत्र, प्रकार
- पारिभाषिक शब्दावली
- अंग्रेजी से हिंदी और हिंदी से अंग्रेजी अनुवाद

संदर्भ ग्रंथ:

- "हिंदी भाषा का उद्भव और विकास" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
- "हिंदी भाषा का इतिहास" – डॉ. रामविलास शर्मा (राजकमल प्रकाशन)
- "भारत में राजभाषा हिंदी" – डॉ. विश्वनाथ प्रसाद (भारतीय राजभाषा परिषद)
- "हिंदी व्याकरण और रचना" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
- "हिंदी लेखन कौशल" – डॉ. रमेश गुप्ता (साहित्य भवन)
- "अनुवाद विज्ञान और सिद्धांत" – डॉ. ओमप्रकाश (राजकमल प्रकाशन)

डॉ. बाबासाहेब आंबेडकर तंत्रशास्त्र विद्यापीठ, लोणेरे

इंग्रजी विभाग

संस्कृत अभ्यासक्रम

Course Code	Course Title	Teaching Scheme			Examination Scheme					
		L	T	P	Continuous Assessment (1)	Continuous Assessment (2)	Mid Term Test	End Semester Exam	Total	Credits
2311372AE204	संस्कृत अभ्यासक्रम	2	0	0	10	10	20	60	100	2

Course Objectives:

- संस्कृत भाषेचा ऐतिहासिक प्रवास
- संस्कृत लेखनाचे नियम, व्याकरण आत्मसात करणे.
- दैनंदिन संवादासाठी लागणारे काही शब्द यांचा अभ्यास करणे.

Course Outcomes:

- विद्यार्थी संस्कृत भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील.
- शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल.
- विविध प्रकारच्या लेखन शैली आत्मसात करून लेखन करू शकतील.
- अचूक, स्पष्ट आणि भाषिक-सांस्कृतिक दृष्टिकोनातून योग्य भाषांतर करू शकतील.

1. Introduction to Sanskrit

- Importance and history of Sanskrit
- Sanskrit alphabets (Varnamala)
- Swaras (Vowels)
- Vyanjanas (Consonants)
- Pronunciation and script (Devanagari)

2. Basic Grammar

- Nouns, pronouns, Grammatical numbers, Grammatical genders, Grammatical person

- Verbs, Tenses, Sandhi (Combination of letters)
- Karaka (Case system) – Nominative, Accusative, Instrumental, etc.
- Vibhakti (Declensions of nouns and pronouns)
- Linga (Gender: Masculine, Feminine, Neuter)
- Vakya Rachana (Sentence construction)

3. Simple Vocabulary and Sentence Formation

- Basic words and their meanings (nature, family, animals, objects, etc.)
- Greetings and basic conversational phrases
- Formation of simple sentences

4. Selected Sanskrit Shlokas and Subhashitas

- Recitation and meaning of simple verses from Bhagavad Gita, Hitopadesha, or Panchatantra
- Common proverbs (Subhashitas)

5. Reading and Writing Practice

- Reading simple Sanskrit texts
- Writing small paragraphs in Sanskrit