B.Sc. (Hons.) in Mathematics & Computing

Effective from Academic Session – 2023-24

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

B. Sc. (Hons.) [Mathematics & Computing] - Curriculum 2023-24

First Semester

S. No.	Category Code	Course Name	Course Code	Core / Elective / NMC	L	T	P	Credits	Contact Hours
1	Core	Calculus	22BS1MA111	Core	3	1	0	4	4
2	Core	Computer Fundamentals	22BS1CI111	Core	3	0	0	3	3
3	Core	Fundamentals of Computer Hardware and Networking	22BS1CI112	Core	3	0	0	3	3
4	AECC-01	English	21B11HS111	AECC-01	2	0	0	2	2
5	AECC-01	English Lab	21B17HS171	AECC-01	0	0	2	1	2
6	Core	Linear Algebra	22BS1MA112	Core	3	1	0	4	4
7	Core	Programming for Problem Solving - II	19B11CI111	Core	2	0	0	2	2
8	Core	Programming for Problem Solving - II Lab	19B17CI171	Core	0	0	4	2	4
					Total			**21**	**24**

Second Semester

S. No.	Category Code	Course Name	Course Code	Core / Elective / NMC	L	T	P	Credits	Contact Hours
1	Core	Discrete Mathematical Structures	22BS1MA211	Core	3	0	0	3	3
2	Core	Fundamentals of Probability and Statistics	22BS1MA212	Core	3	1	0	4	4
3	Core	Data Structures and Algorithms	18B11CI211	Core	3	1	0	4	4
4	Core	Introduction to Object-Oriented Programming	22BS1CI211	Core	3	1	0	4	4
5	SEC-01	UHV II - Understanding Harmony	23B11HS211	Elective (SEC-01)	2	1	0	3	3
6	SEC-01	Professional Communication Practices	23B11HS212	Elective (SEC-01)	0	1	0	0	1
7	AECC-02	Environmental Studies	18B11GE411	AECC-02	2	0	0	2	2
8	Core	Data Structures and Algorithms Lab	18B17CI271	Core	0	0	4	2	4
9	Core	Introduction to Object-Oriented Programming Lab	22BS7CI271	Core	0	0	2	1	2
					Total			**23**	**27**

Third Semester

S. No.	Category Code	Course Name	Course Code	Core / Elective / NMC	L	T	P	Credits	Contact Hours
1	Core	Introduction to Numerical Computing	24BS1MA311	Core	3	0	0	3	3

2	Core	Real Analysis and Differential Equations	24BS1MA312	Core	3	1	0	4	4
3	SEC-01	Life Skills and Interpersonal Dynamics	23B11HS311	Elective (SEC-01)	3	0	0	3	3
4	DSE-01	Database Management Systems	18B11CI313	Elective (DSE-01)	3	0	0	3	3
5	DSE-02	Python Programming Essentials	18B11CI314	Elective (DSE-02)	3	0	0	3	3
6	DSE-01	Database Management Systems Lab	18B17CI373	Elective (DSE-01)	0	0	4	2	4
7	DSE-02	Python Programming Lab	18B17CI374	Elective (DSE-02)	0	0	4	2	4
8	Core	Introduction to Numerical Computing Lab	24BS7MA371	Core	0	0	2	1	2
9	Core	Minor Project - I	24BS9MA391	Core	0	0	6	3	6
					Total			**24**	**32**

Fourth Semester

S. No.	Category Code	Course Name	Course Code	Core / Elective / NMC	L	T	P	Credits	Contact Hours
1	Core	Optimization for Data Science	24BS1MA411	Core	3	0	0	3	3
2	DSE-03	Multivariate Calculus in ML	24BS1MA412	Elective (DSE-03)	3	0	0	3	3
3	GE-01	Finance and Accounts	18B11HS411	Elective (GE-01)	3	0	0	3	3
4	Core	Design & Analsysis of Algorithms	18B11CI412	Core	3	0	0	3	3
5	DSE-04	Modeling and Simulation Techniques	18B11CI413	Elective (DSE-04)	2	0	0	2	2
6	Core	Optimization for Data Science Lab	24BS7MA471	Core	0	0	2	1	2
7	DSE-03	Multivariate Calculus in ML Lab	24BS7MA472	Elective (DSE-03)	0	0	2	1	2
8	Core	Design & Analsysis of Algorithms Lab	18B17CI472	Core	0	0	4	2	4
9	Core	Minor Project - II	24BS9MA491	Core	0	0	6	3	6
					Total			**21**	**28**

Summary

Semester		Credits
I		21
II		23
III		24
IV		21
V		25
VI		23
VII		14
VIII		11
Total		**162**

CALCULUS

COURSE CODE:
22BS1MA111 COURSE
CREDITS: 4
CORE/ELECTIVE: CORE
L-T-P : 3-1-0

Pre-requisite: None

Course Objectives: This course gives a foundation on Calculus Differential &Integral and emphasizes

- To learn fundamental concepts of one variable calculus and its applications.
- To study the hyperbolic functions, and basics of curves.
- To learn basic concepts of definite integrals and its applications.
- To study fundamentals of the sequence and series.
- To introduce the extension of single variable calculus to multivariable calculus.

Course Outcomes: On Completion of this course the students will be able to:

S.No.	Course Outcomes	Level of Attainment
CO-1	Compare and contrast the ideas of continuity and differentiability. To find maxima and minima, critical points and inflection points of functions	Familiarity
CO-2	Recognize the appropriate tools of calculus to solve applied problems, curve tracing and understand the special functions and various co- ordinate systems	Assessment
CO-3	To understand the fundamental theorem of calculus, and some applications of definite integrals to investigate length of curves, moments and center of mass, surfaces of revolutions, and improper integrals**.**	Assessment
CO-4	To understand various types of convergence of sequence and series, Power series. Moreover, a brief introduction to multivariable calculus: limits and continuity, partial derivatives,Homogeneous Functions and Euler's theorem withapplications.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Single Variable Calculus: Limits and continuity of single variable functions, differentiation and applications of derivatives,Maxima and Minima, Extrema on an interval, Rolle's Theorem, Mean Value Theorem and Applications, Fundamental Theorem of Calculus.	9
2	Transcendental Functions, Hyperbolic functions, higher order derivatives, Leibnitz rule, curvature, curve tracing in Cartesian coordinates. Polar coordinates, parametric equations, Parameterization of a curve, arc length of a curve.	9
3	Definite integrals, fundamental theorem of calculus, Applications to length, moments and center of mass, surfaces of revolutions, improper integrals.	9
4	Sequences, Series and their convergence, absolute and conditional convergence, Uniform convergence, power series, Taylor's and Maclaurin's series	8
5	Introduction to Multi-variable Calculus: Functions of several variables- limits and continuity, partial derivatives, Chain rule, Homogeneous Functions and Euler's Theorem and Applications.	7
Total Lectures		42

Suggested Text Book(s):

1. G.B. Thomas and R.L. Finney, ``Calculus and Analytic Geometry, Pearson Education India.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

Suggested Reference Book(s):

3. Gilbert Strang, "Calculus", Wellesley-Cambridge Press; 2nd edition, 2010.
4. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Calculus)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	
Average													

Computer Fundamentals

COURSE CODE: 22BS1CI111
COURSE CREDITS: 3
CORE/ELECTIVE: Core
L-T-P : 3-0-0
Pre-requisite: None
Course Objectives:

1. Learn the computer organization.
2. Learn various number systems and conversion.
3. Learn various data design paradigms.
4. Learn basic computer operations and its logical implementation.
5. Planning the computer program.
6. Learn the basic association with computer environment.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Comprehension of the computer design.	Familiarity
CO-2	Demonstrate the logic of computer system.	Assessment
CO-3	Understanding and application of computer language .	usage
CO-4	Understanding of association with computer environment	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Introduction to computers: Data processing, Characteristic features of computers, Computers' evolution to their present form, Computer generations, Characteristic features of each computer generation, Basic operations performed by all types of computer systems, Basic organization of a computer system, Input unit and its functions, Output unit and its functions, Storage unit and its functions, Types of storage used in a computer system	8
2	Number system: Non-positional number system , Positional number system, Decimal number system, Binary number system, Octal number system, Hexadecimal number system,Computer code: Computer data, Computer codes: representation of data in binary, Most commonly used computer codes, Collating sequence	8
3	Computer arithmetic: Reasons for using binary instead of decimal numbers, Basic arithmetic operations using binary numbers, Addition (+) , Subtraction (-) ,Multiplication (*), Division (/) Boolean algebra and logic circuit: Fundamental concepts and basic laws of Boolean algebra, Boolean function and minimization, Logic gates, Logic circuits and Boolean expressions, Combinational circuits and design	6
4	Processor and Memory: Internal structure of processor, Memory structure, Determining the speed of a processor, Different types of processors available, Determining the capacity of a memory, Different types of memory available, Several other terms related to the processor and main memory of a computer system Secondary storage device: Requirement, Classification of commonly used secondary storage devices, Difference between sequential and direct access storage devices ,Basic principles of operation, types, and uses of popular secondary storage devices such as magnetic tape, magnetic disk, and optical disk	8
5	Programming language: Introduction, Generation of programming language, Characteristics of good programming language, Assembly language, Categorization of High level language, Develop a programme, Compiling High level language programme, some high level language	6
6	Computer software: Types of computer software, system management	6

	programs, System Development Programs, standard application programs, unique application programs Operating system: Classification of OS (multi programming, time sharing), function of OS, Unix OS, Microkernel based OS, Online and Real time OS	
Total lectures		42

Suggested Text Book(s):

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India),Pvt. Ltd., 2004
3. Optimization for Engineering Design. K Deb.

Suggested Reference Book(s):

1. Sheskin, David J. (2003) Handbook of Parametric and Nonparametric Statistical Procedures. CRC Press.
2. Optimization concepts and applications in engineering, A. D. Belegundu and T. R. Chandrupatla.
3. Linear and Nonlinear programming. Stephen G. Nash and A. sofer

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/111/105/111105039/
2. Link to NPTEL course contents : https://nptel.ac.in/courses/111/104/111104068/
3. Link to NPTEL course contents : https://nptel.ac.in/courses/112/106/112106131/

.Link to topics related to course:

i. https://nptel.ac.in/courses/112/106/112106134/
ii. https://nptel.ac.in/courses/112/106/112106131/
iii. https://nptel.ac.in/courses/106104019/26
iv. https://nptel.ac.in/courses/111/105/111105

039/ Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Parallel and Optimization Methods in Business Analytics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	
Average													

Fundamentals of Computer Hardware and Networking

COURSE CODE: 22BS1CI112
COURSE CREDITS: 3
CORE/ELECTIVE: Core
L-T-P : 3-0-0

Pre-requisite: None

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To know the concept of data transfer between nodes
3. To learn the fundamentals of Comprehension of the computer design.
4. Learn Internal and External components of computer.
5. Describe and analyze computer hardware, software, and the internet.
6. Understanding of components of networking.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Comprehension of the computer design.	Familiarity
CO-2	Learn Internal and External components of computer	Assessment
CO-3	Understanding the overview of networking.	Familiarity
CO-4	Understanding of components of networking	Familiarity
CO-5	Understanding PC Architecture & Microprocessor system	Familiarity
CO-6	Understanding Transmission Media and Topologies Media types	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Microprocessor System:Introduction of System overview, Introduction to Processors, Memory Interfacing, Interfacing I/O Devices, Interfacing Data Converters, Display Interface, Serial I/O and Data Communication, Higher level Processors	7
2	Introduction to PC Architecture:Study of PC-AT/ATX System, Pentium, Core, Core 2 Cord, Core 2 Duo, I3, I5, I7 Processor Basics of Processor and CPU Block Diagram of Computer and Computer Generation Motherboards, Chipset and Controllers, BIOS and the Boot Process, Computer Memory.	6
3	Internal Components:IDE and SATA Devices: Hard Disk Drive and CD/DVDs Drives, SCSI Devices, Floppy Disk, Zip Drive, Backup Drive, Expansion Cards- LAN Card, IDE Card , VGA and SVGA Cards, Sound Card, Interface Cards, I/O cards, Video Cards, USB Card, Fire-Wire Cards, Internal Ports, Cables and Connector Types. External Components Monitors:CRT, LCD and LED Displays, Printers:- Dot-Matrix Printer, Inkjet Printer, Laser Printer Scanner:- Photo Scanner, Documents Scanner, Bar Cord Scanner Keyboards, Mouse, External Modem, Ports and Connectors, Batteries, Power supply, Pen Drives, SCSI interface devices, Laptop Computers, Digital Advance storage technology.	8
4	Network Components:Introduction of Network Cable like UTP, STP, Fiber Optics, Hub, Unmanageable Switch, Manageable Switch, Router, Modem, Wi-Fi, Access Point, PCI Wireless Card, USB Wireless Device, Print Server, USB Network Sharer, Backup Device, Server Hardware etc.	7
5	Overview of Networking:Introduction to networks and networking, LAN, VLAN, CAN, MAN, WAN, Internet and Intranet etc. Uses and benefits of Network, Server-client based network, peer to peer networks. Network Hardware and Components Concept of Server, client, node, segment, backbone, host etc. Analog and Digital transmission, Network Interface Card, Crimping tools and Color standards for Straight crimping and Cross crimping	7

	Functions of NIC,Repeaters, Hub, Switches, Routers, Bridges, Router etc.	
6	Transmission Media and Topologies Media types:STP cable, UTP cable, Coaxial cable, Fiber cable, Base band and Broadband transmission, Cables and Connectors, Physical and logical topologies, Bus, Star, Ring and Mesh topologies	7
Total lectures		42

Suggested Text Book(s):

1) Networking Complete BPB Publication
2) Computer Networking Andrew S. Tanenbawan By PHI
3) Microprocessor Architecture Programming and Application with the 8085 Ramesh Gaonkar Penram International Publication

Suggested Reference Book(s):

1) Electronics and Radio Engineering M.L. Gupta Dhanpat rai & Sons, New Delhi 2004.
2. Anita Goel, Computer fundamentals By Pearson, 1st edition, 2010.

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	1.83
CO2	3	3	3	3	3	1	1	1	1	1	1	3	2.00
CO3	3	3	2	3	2	3	2	1	1	1	2	1	2.00
CO4	3	3	3	2	3	2	1	1	1	1	1	1	1.83
CO5	2	2	3	3	3	3	1	1	1	1	1	1	1.83
C06	2	3	3	3	2	2	2	2	2	2	2	2	2.25
Average	2.67	2.83	2.80	2.80	2.60	2.20	1.20	1.00	1.00	1.00	1.20	1.40	

English

COURSE CODE: 21B11HS111
COURSE CREDITS: 2
CORE/ELECTIVE: CORE
L-T-P : 2-0-0

Pre-requisite: None

Course Objectives:

1. The Student will be able to analyze communication situations and audiences to make choices about the most effective and efficient way to communicate and deliver messages.
2. The student will learn to deliver effective presentations in contexts that may require power point, extemporaneous or impromptu oral presentations
3. The student will learn to write grammatically correct business documents using appropriate business style.
4. The student will learn to speak and write grammatically correct sentences with the ability to express thoughts with clarity and accuracy.
5. Students will develop command over their language and synchronize their thoughts into written form

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Understand and learn the concepts of better and effective communication	Familiarity
CO2	Learn the basics of business etiquettes, values and personal goal setting	Familiarity
CO3	Enable students to prepare better Power Point Presentations with clarity of expression and appropriate language.	Assessment
CO4	Help make communication stronger by learning the nature and mechanics of effective writing.	Assessment
CO5	Learn the different formats of business writing with correct knowledge of grammar.	Usage
CO6	Develop command over language, using techniques of vocabulary building and identifying common errors, redundancies and grammatical syntax.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Concept and Nature of Communication**: What is communication? Stage o communication. Ideation, encoding, transmission, decoding & response Channels o communication. Communication in organizational settings Etiquettes in social and Office settings. Work culture in Jobs Barriers to effective communication. Guidelines t overcome communication barriers	4
2	**Self Development and Assessment:** Self Assessment, Awareness,. Personal goal Setting	2
3	**Effective presentation:** Pre- presentation jitters. Preparation and practice Delivering the presentation. Qualities of a skilful presenter. Capturing and maintaining attention Handling questions Power point presentations	4
4	**Nature and Mechanics of Writing (Basic Writing Skills):** Technique for writing precisely: Defining. Describing, Classifying. Use of Phrase and Clauses in sentences Importance of Proper Punctuation. Organizing Principles of Paragraphs in documents	5
5	**Technical Writing:** Importance, structure and drafting and revising o Technical Reports. Technical writing style and Language. Busines writing: Letters, Preparing resume, notices, agenda and minutesof meeting ,Daily Dairy entry	6
6	**Vocabulary Development:** Word Formation. Derivatives: Prefixes & Suffixes. Roo words. Synonyms, Antonyms, Homophones and Homonyms One word substitution	2
7	**Grammar and Usage**: Subject-Verb Agreement. Noun-Pronoun Agreement. Prepositions, Articles	3
8	**Identifying Common errors in writing :** Redundancies, Clichés , Misplace modifiers, words often confused and misused	2
Total lectures		**42**

Suggested Text Book(s):

1. Practical English Usage. Michael Swan. OUP.1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001.
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. OUP

6. A Communicative Grammar of English. 3rd Edn. G. Leech and J. Svartvik. 2012
7. Williams, K., Krizan, A. C., Logan, J. & Merrier, P. (2011) Business Communicating in Business 8th Ed. New Delhi: CengageLearning.
8. Murphy, Herta A., Herbert Hildebrandt, Jane Thomas (2008) Effective Business Communication 7th Ed. New Delhi:Tata Mcgraw Hill Education Private Limited.
9. Guffey, M. A. (2000) Business Communication: Product & Process South-Western College Publishing.

Suggested Reference Book(s):

1. Lesikar, R. V., Flatley, M.E., Rentz, K. & Pande, N. (2009) Business communication 11th Ed. New Delhi: Mc Graw Hill.
2. Communication Skills. Sanjay Kumar and Pushp Lata. OUP. 2011.
3. Williams, K., Krizan, A. C., Logan, J. & Merrier, P. (2011) Business Communicating in Business 8th Ed. New Delhi: CengageLearning.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3	T-3	35	2 Hours	Entire Syllabus
4	Teaching Assessment	25	Entire Semester	Etiquettes in Social and Office Settings (5) Self Development and Assessment (8) Notice and letter Writing/Report Writing(12)

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (English and Technical Communication)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	1	3	3	3	1	2	3	3	3	3	1	3	2.4
CO-2	1	2	3	2	1	1	2	3	3	3	1	3	2.0
CO-3	1	2	3	2	2	2	1	2	3	3	1	3	2.0
CO-4	1	1	2	3	2	1	1	3	2	3	1	3	1.9
CO-5	1	2	3	2	2	2	1	3	2	3	1	3	2.0
CO-6	1	2	2	2	2	2	1	3	2	3	1	3	2
Average	1	2	2.6	2.3	1.6	1.6	1.5	2.8	2.5	3	1	3	

English Lab

COURSE CODE: 21B17HS171
COURSE CREDITS: 1
CORE/ELECTIVE: CORE
L-T-P : 0-0-2

Pre-requisite: None
Course Objectives:

1. The students will learn to speak and write grammatically correct sentences with the ability to express thoughts with clarity and accuracy.
2. The students will learn the rules of grammar in writing. It will enhance their ability to use logical sequencing while writing any business letter or document.
3. The students will learn using new words and build their vocabulary steadily and systematically by following the exercises.
4. Students will develop command over their language and synchronize their thoughts while writing different types and kinds of Business letters.
5. Students will be groomed to develop the art of speaking logically, confidently and pragmatically which involves understanding work ethics and manners and the correct use of body language.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Understand and sharpen writing skills using correct grammar in Emails, Business letters and Report writing.	Usage and Assessment
CO2	Learn the basics of successful job applications.	Usage and Assessment
CO3	Help make communication stronger by learning Non verbal cues and correct Body Language.	Familiarity and Assessment
CO4	Enable students to prepare better Power Point Presentations with clarity of expression and appropriate language.	Familiarity and Assessment
CO5	Develop advanced vocabulary by learning to use different ways of word construction and strategies of learning new words.	Usage and Assessment
CO6	Learn about the ethics of writing and different types of formats in documents with command over language.	Usage and Assessment

List of Exercises

Subject Code	21B17HS171	**Semester**	1
Subject Name	English Lab		
Credits	01	**Contact Hours**	14

Faculty (Names)	**Coordinator(s)**	1. Dr. Papiya Lahiri
	Teacher(s) (Alphabetically)	1. Dr. Papiya Lahiri 2. Dr. Neena Jindal

Lab Exercise No.	Subtitle of the Module	Topics	Hours
1.	**Essays: For and Against** **Software: Practical Writing**	What will I learn? Stages of writing Brainstorming (1) Brainstorming (2) Planning your essay (1) Choosing a style Quick quiz: the Writing Process	1

2.	**Job Applications: Your Online Profile** **Software: Practical**	What will I learn? Your online profile: overview	1
	Writing	What does a profile look like The structure of a profile Proofreading: grammar Spell checking Writing focus: punctuation marks Practise proofreading Quick quiz: your personal profile	
3.	**Official Letters** **Software: Practical Writing**	What will I learn in this unit? Official letters: layout Official letters: vocabulary Build up an official letter Letters: style The cover letter: job applications Letters: proofreading Present perfect or simple past? Quick quiz: letters	1
4.	**Emails: Asking for Information (I)** **Software: Practical Writing**	What will I learn? Emails: an overview Emails: structure Finding functional language (study sheet) Asking people to do things Enquiries and Responses	1
5.	**Emails: Asking for Information (II)** **Software: Practical Writing**	Functional language for emails Emails: Correcting mistakes Write two emails (on PC note pad) Vocab Focus Quick quiz: Email basics	1
6.	**Use of Body Language**	This exercise will include showing a couple of videos to the students on the use of Body Language in communication and also how to interpret other people's body language when they communicate. This will include studying facial expressions, gestures, non- verbal cues and eye contact.	1
7.	**A Short Report: Graphs (I)** **Software: Practical Writing**	What will I learn in this unit? A report on graph Choosing tenses (1)	1

		Choosing tenses (2) Write a report (1) [on PC note pad] Prepositions of time (1) Describing differences (1) Quick quiz: A report on graphs	
8.	**A Short Report: Hotel and restaurants (II)** **Software: Practical Writing**	What will I learn? Restaurant reviews: structure Vocab: Hotels and restaurants Topic sentences (1) Mixing sentences (1) Mixing sentences (2) Past or Present? Write two reviews (Any one of the two on PC note pad) Quick quiz: a short report	1
9.	**Use of Power point presentation**	This exercise will comprise of two videos on the specifics of preparing power- point presentations; the Do's and don'ts; examples from successful business entrepreneurs' presentations.	1
10.	**Vocabulary Development**	Synonyms, Antonyms, Standard Abbreviations One word Substitution Homophones, Homonyms, Paronyms, Words often confused and misused Word Functioning Idiomatically Foreign Words Prefixes Suffixes (5 each on PC note pad)	1
11.	**Reported Speech** **Software :Tense Buster**	Introduction The Rule Practice: Pronouns	1

		Practice: Verbal Actions Pronunciation: Stress and Rhythm Do you understand? Vocab: Reporting verb Your test	
12.	**Essays: Descriptive** **Software: Practical Writing**	What will I learn? Planning your essay (1) Planning your essay (2) Words and senses (1) Vocab focus: choosing precise words Linking ideas (1) Linking ideas (2) Quick quiz: descriptive essays	1
13.	**Avoiding Plagiarism Ist part** **Software: Practical Writing** **Taking Notes IInd part** **Software: Practical Writing**	What will I learn? Plagiarism: an overview Identify plagiarism Past or present? Quick quiz: plagiarism <u>Taking notes</u> What will I learn? Taking notes: the main points Taking notes: the layout Taking notes: abbreviations Quick quiz: taking notes	1
14.	**Text speak** **Software: Practical Writing**	What will I learn? Text speak: an overview Text terms (1) Text terms (2)	1

		Inviting people to do things Responding appropriately Text speak and speaking Quick quiz: text speak	
		Total	14

Methodology

The course follows a lab based teaching-learning method with classroom discussions and activities on fundamental concepts of grammar with a strong emphasis on skill development of students with regard to speaking, writing, logically interpreting ideas into words and reasoning in the classroom. The exercises are solved by the students on the software's and the marking is automatically shown. Additionally, they are asked to draft letters and memos in their Lab files/registers after reading specimens on the software's and improve their English with choice of specific and technical words.

Evaluation

Sr. No.	Components	Total Marks
1	Proforma	10
2	Mid Term	20
3	End term	20
4	Tutorial Activities	50
	Total	100

SOFTWARE DETAIL

There are presently three softwares running in the Language Lab. These are as follows:

1. **Software Clarity S. Net 7**

This software supports Wireless LAN and wired LAN.

Main Functions

1. Screen Broadcast: Teacher PC can broadcast the screen, video file, flash smoothly without delay to student PC.
2. Voice Broadcast: Teacher can broadcast his voice without delay to student PC.
3. Screen Recorder: Teacher and student can record their own operations and then save in video file, which can be broadcast in any PC which has installed media player
4. Monitor: Teacher can monitor any student PC in the classroom.
5. Media Player. Teacher can broadcast all kinds media file formats, such as MPEG, DAT, MVI and so on, to student PC without delay.
6. Control Website and application: Teacher can restrict student to visit any website or application freely.
7. Teacher can remote open website on student PC.
8. Group Teaching: Teacher can divide the students into several groups, and set leader for each group to run group teaching.
9. Exam: It has strong exam functions. Teacher can know student study progress from students by using this function easily.
10. Remote Command: Teacher can remote run the program in student PC; teacher can remote start-up, turn off and restart student computer.
11. File transfer and collect the file: Teacher can transfer the file to student PC easily, and also teacher can collect the file from student PC.

12. Restrict USB: Teacher can restrict student to use USB flash memory freely. 13. Digital Recorder: It can record teacher and student voice, which can be used in language lab.

Requirements

Teacher side Requirements: CPU Core 2 E6300, 2Gbytes Memory, 256Mbytes Display Card

Student side Requirements: CPU Core 2 E4300, 1Gbytes Memory, 128Mbytes Display Card

Operating System: Support all Windows, includes Windows 8.1,8, 7, Vista, XP and so on. Network: Wired Network 10MB/100MB/1000MB. Wireless Network 802.11n.

Overview:

Clarity English publishes programs, aimed at specific language areas in English like Grammar, Reading, Study Skills & Results Tracking. Under 'Clarity English', there are three softwares in our language lab which are Tense Buster, Practical Writing and Clear Pronunciation. The Program named Tense Buster focuses on 33 areas of Grammar through reading, listening, speaking & writing. It is one of a kind which is accepted by British Council in all its 226 teaching centres.

2. Software: Tense Buster 9.0 (3 years) Licence Details

Tense Buster V11

Licence type: Anonymous Access

Version: International English

Number of concurrent users:

33 Start date: 2021-08-09

Expiry date: 2025-08-08

Tense Buster is an ESL (English as a second language) program which focuses on helping students improve their reading, writing, listening, speaking, vocabulary and grammar skills in 5 levels (beginner, upper intermediate, intermediate, lower intermediate, advanced).

Tense Buster covers 33 aspects of the English language through presentations, practice exercises, rules, tests and learner training tips. Students learn how to ask questions, make comparisons, and report on what they've heard, in addition to learning how to describe past, present and future events.

Each unit begins with a presentation of a grammar topic based on a dialogue, a newspaper article, a radio broadcast or an extract from a story, where learners are encouraged to form theories about how the grammar works. Next comes checking questions focusing on key areas of difficulty, and a grammar rule. Students move on to practice and testing activities in which the language is contextualized and key aspects of form and function are highlighted. Each unit includes a video-based pronunciation activity relating to an aspect of the grammar. Finally, each unit includes a vocabulary session and ends by suggesting extension activities. All activities include detailed feedback.

Multimedia Authoring Kit

This kit enables the teacher to create effective exercises tailored to students' specific needs. The Tense Buster multimedia Authoring Kit comprises a wide range of exercise types. It lets you add your own material and adapt the courses to the needs of your students. Use any one of

these formats to create your own activities: drag and drop, proof reading and free practice as well as target spotting, multiple choice questions, true/false, text and gap fill.

3. Software: Practical Writing Licence Details (3 years)

Practical Writing V11

Licence type: Anonymous Access

Version: International English
Number of concurrent users:
33 Start date: 2021-08-09
Expiry date: 2025-08-08
This cloud based software helps in developing the writing skills of the students. It has 10 core skill development areas:

1. Essays: For and Against
2. Job Applications: your online profile
3. Emails: Asking for Information
4. A Short Report: Graphs
5. A Short Report: Hotels and Restaurants
6. Avoiding Plagiarism
7. Taking Notes
8. Essays: Descriptive
9. Textspeak
10. Official Letters

Each area deals with a separate set of exercises that are designed to master the skill set of LSRW. It entails learning about reports, cover letters, resumes, drafting business letters, textspeak, spell check etc. It covers a wide range of topics on grammar, functional language, formal and communicative language. The Lab exercises will be covered from Tense Buster and Practical Writing software.
Every week the students perform the exercises and enter their auto-system-generated scores on the printed pro forma.

4. Software: Clear Pronunciation 2
V11 License Details (1 year)

Clear Pronunciation 2 V11
Licence type: Anonymous Access

Version: British English
Number of concurrent users: 33 Start date: 2021-08-09
Expiry date: 2022-08-08

This software is particularly for learning and practicing phonetics or the study of the sounds of human speech. It deals with five distinct areas:

- Consonant Clusters
- Word Stress
- Connected Speech
- Sentence stress
- Intonation

All these areas will make the students practice correct pronunciation and listen to their own recorded voices and make improvement.

LINEAR ALGEBRA

COURSE CODE: 22BS1MA112
COURSE CREDITS: 4
CORE/ELECTIVE: CORE
L-T-P : 3-1-0

Course Objectives: On successful completion of this course, a student will be able

1. To solve system of linear equations, and interpret existence and uniqueness of solutions geometrically.
2. To learn and recognize linear independence, span and dimension, and apply them to vector spaces.
3. To learn eigenvalues, eigenvectors and understand the idea behind diagonalization process.
4. To understand the relationship between a linear transformation and its matrix representation.
5. To describe vector projections, compute orthonormal basis and spectral decomposition.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the roll of matrices and their properties to solve the system of linear equations;	Familiarity
CO-2	Find eigenvalues, eigenvectors of matrices and perform diagonalization.	Assessment
CO-3	Understand linear transformation and find the matrix representation; Compute eigenvalues and eigenvectors of a square matrix; Perform factorization of a square matrix.	Assessment
CO-4	Understand basic concepts of inner product on vector spaces; Compute the orthogonal projection of a vector onto a subspace; Construct an orthonormal basis for an inner product space using the Gram Schmidt process.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Matrices:** Algebra of matrices, row echelon form, row reduced echelon form, inverse and rank of a matrix; Kernel or Null space and solutions of linear system of equations by Gauss Elimination, Gauss-Jordan method, LU decomposition (of a matrix); Cayley-Hamilton Theorem.	**8**
2	**Vectors space:** Basics of groups, rings and fields; real and complex vector spaces; properties of vector spaces; linear dependence, basis and change of coordinates in R^n; linear span, dimension of vector space; Steinitz exchange lemma; row and column spaces associated to a matrix.	**8**
3	**Vectors and transformations:** Linear transformations - image and kernel of a linear transformation; Rank-Nullity theorem; matrix representations, change of basis, dual bases; implications for linear systems.	**8**
4	**Inner product spaces:** Introduction, norm of a vector, Cauchy-Schwarz Inequality, Triangle Inequality, generalized theorem of Pythagoras; direct sum of subspaces and its orthogonal complement; fundamental subspaces associated to a matrix and Fundamental theorem of Linear Algebra; Gram-Schmidt orthonormalization, orthogonal projections and least-square problems; Adjoint of a linear operator and linear functional.	**10**
5	**Matrix Factorization:** Eigenvalues and Eigenvectors, diagonalization – orthogonal diagonalization of symmetric matrices; Complex matrices and eigenvalues - Hermitian and unitary and normal matrices; Spectral theorem; Application of eigenvalues and in discrete dynamical systems.	**8**
Total Lectures		**42**

Suggested Text Book(s):

1. Gilbert Strang, ``Linear Algebra and Learning from Data,'' Wellesley-Cambridge Press, 2019.

2. R. K. Jain & S. R. K. Iyenger, ``Advanced Engineering Mathematics,” 5th Edition, Narosa Publishing House, New Delhi, India, 2017
3. Ward Cheney, David R. Kincaid, ``Linear Algebra: Theory and Applications,”2nd Edition, Jones & Bartlett Learning, 2012.
4. David Poole, `` Linear Algebra: A Modern Introduction,” 3rd Edition, Cengage, 2011.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Linear Algebra)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	2	2	2	1	2	1	2	2	2	2	**1.9**
CO-2	2	3	2	3	2	1	2	1	2	2	2	2	**2**
CO-3	2	2	3	2	2	1	2	1	2	2	2	2	**1.9**
CO-4	3	3	3	3	2	1	2	1	2	3	3	2	**2.3**
Average	**2.5**	**2.5**	**2.5**	**2.5**	**2**	**1**	**2**	**1**	**2**	**2.3**	**2.3**	**2**	

Programming for Problem Solving-II

COURSE CODE: 19B11CI111
COURSE CREDITS: 2
CORE/ELECTIVE: CORE : 2-0-0

Pre-requisite: None

Course Objectives:

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Course outcomes:

S.NO	Course outcomes	Level of Attainment
CO-1	To formulate simple algorithms for arithmetic and logical problems.	Familiarity
CO-2	To translate the algorithms to programs (in C language).	Familiarity
CO-3	To test and execute the programs and correct syntax and logical errors.	Usage
CO-4	To implement conditional branching, iteration and recursion.	Usage
CO-5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.	Usage
CO-6	To use arrays, pointers and structures to formulate algorithms and programs.	Usage
CO-7	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	Assessment
CO-8	To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Programming (4 lectures)** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture). **Idea of Algorithm:** steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2lectures)	4
2	**Arithmetic expressions and precedence**	2
3	**Loops:** Conditional Branching and Loops (6 lectures) Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures)	6
4	**Arrays:** Arrays (1-D, 2-D), Character arrays and Strings	6
5	**Basic Algorithms:** Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required.	6

6	**Function:** Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	**5** **4**
7	**Structure:** Structures, Defining structures and Array of Structures	**4**
8	**Pointers:** Idea of pointers, Defining pointers, Use of Pointers in self- referential structures, notion of linked list (no implementation) **File handling**	**3** **2**
Total lectures		**42**

Suggested Text Book(s):

1. Byron Gottfried, Schaum's Outline of Prokli[gramming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Book(s):

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc18-cs10
2. Link to topics related to course:
   a. **https://www.learn-c.org/**
   b. **https://www.programiz.com/c-programming**
   c. **https://www.codechef.com/ide**

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Programming for Problem Solving)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	3	2	2	3	2	3	2	2	3	3	**2.5**
CO-2	3	2	3	2	2	3	3	2	2	3	3	3	**2.6**
CO-3	2	2	2	2	2	3	3	3	2	2	3	3	**2.4**
CO-4	3	2	3	2	3	2	2	3	3	3	2	2	**2.5**
CO-5	3	2	2	2	3	2	2	2	2	3	3	3	**2.4**
CO-6	2	3	3	3	3	2	3	2	2	3	3	2	**2.6**
CO-7	2	2	2	2	2	3	3	3	2	2	3	3	**2.4**
CO-8	3	2	3	2	2	3	2	3	2	2	3	3	**2.5**
Average	**2.6**	**2.1**	**2.6**	**2.1**	**2.4**	**2.6**	**2.5**	**2.6**	**2.1**	**2.5**	**2.9**	**2.8**	

Programming for Problem Solving Lab-II

COURSE CODE: 19B17CI171
COURSE CREDITS: 2
CORE/ELECTIVE: CORE
: 0-0-4

Pre-requisite: No prior programming experience is expected however, mathematical maturity level of science or engineering undergraduate is assumed.

Course Objectives:

1. Develop problem solving ability using programming.
2. To impart adequate knowledge on the need of programming languages and problem solving techniques.
3. To develop a methodological way of problem solving
4. Analyze and construct effective algorithms
5. Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines
6. Learn a programming approach to solve problems

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.	Familiarity
CO-2	Introduction to C Programming using Control Statements and Repetition Statement	Usage
CO-3	Apply and practice logical formulations to solve some simple problems leading to specific applications.	Assessment and Usage
CO-4	Design effectively the required programming components that efficiently solve computing problems in real world.	Assessment & Usage

List of Experiments:

S.No	Description	Hours
1	Getting acquainted with the C program Structure and basic I/O. Getting acquainted with the various data types and arithmetic operator used in C.	2
2	Write a program to obtain the reversed number and to determine whether the original and reversed numbers are equal or not.	2
	Write a program to check whether a triangle is valid or not, when the three angles of triangle are entered through the keyboard. A triangle is valid if the sum of all three angles is equal to 180 degrees. Check a given I/P is character, number or special symbol.	
3	WAP to check a given number is Armstrong or not. Calculate factorial of a number Given number is prime or not.	2
4	Write a program to add first seven terms of the following series using any loop: 1/1! + 2/2! + 3/3! +…..Any five pattern program.	2
5	WAP to swap two numbers with function using 3rd variable or without using (call by value & reference). Write a function to find out the roots of quadratic equation.	2
6	Factorial using recursion Fibonacci series using recursion.	2
7	WAP to sort N elements of an array using bubble sort.WAP for Binary search & linear search.	2
8	Find Max, Min, 2nd Max, Standard Deviation. everse elements of an array.	2
9	Matrix addition, Multiplication and Transpose.	2
10	WAP to handle pointer variables and access the elements of an array using pointers.WAP to insert a string and perform operations: string length, copy, concatenation, compare, lower to upper, etc.	2
11	Write a program to find whether the string is palindrome or not using pointersWrite a program to delete all vowels from sentence, assume that sentence is not more than 80 character long using pointers.	2
12	Enter the detail of 5 students using structure and print the details of all students including pointers and also sort the detail of students using DOB.	2
13	Dynamic allocation function and random function with string and integer array.	2
14	Perform operation on files: open, read, write, close etc.	2

Total Lab hours	28

Suggested/Resources:

1. Yale N. Patt and Sanjay J. Patel, Introduction to Computing Systems, from bits & gates to C & beyond, 2nd Edition, 2004.
2. Deitel and Deitel, C How to Program, 7th Edition, 2013.
3. Venugopal Prasad, Mastering C, Tata McGraw Hill.
4. Complete Reference with C, Tata McGraw Hill.
5. Drmey, How to solve it by Computer, PHI.
6. Kerninghan and Ritchie, The C Programming Language.
7. http://www.acm.uiuc.edu/webmonkeys/book/c_guide/
8. http://msdn.microsoft.com/en-us/library/25db87se.aspx

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	Average
CO1	3	3	1	1	2	2	1	1	1	2	1	2	**1.7**
CO2	3	3	2	1	3	1	1	1	1	2	1	2	**1.8**
CO3	3	3	2	2	2	3	2	1	1	2	2	2	**2.1**

Discrete Mathematical Structure

COURSE CODE: 22BS1MA211
COURSE CREDITS: 3
CORE/ELECTIVE:
L-T-P : 3-0-0

Pre-requisite: Basic Mathematics

Course Objectives:

1. Use of various set operations, relations and functions concept to solve applied problems.
2. To simplify and evaluate any logical expression and to express logical statements in terms of logical connectives, predicates and quantifiers.
3. To learn and perform various graphs and trees terminologies, traversals & their applications.
4. To learn the use of finite state machines

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand setoperations, various types of relations & their representations, solving recurrence relations	Familiarity
CO-2	comprehend the discrete structures of lattices, Propositions with proof of validity of arguments and quantifiers	Assessment
CO-3	Understand various types of graphs, paths, spanning tree ,planarity of graphs and coloring theorems	Usage
CO-4	Recognize Algebraic structures; Groups, Subgroups, Rings, Fields with extension to concepts of vector spaces, dimensions and linear transformations.	Assessment
CO-5	Comprehend Languages, grammars, finite state automata & finite state machines.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Set, Relations and Functions**: Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Partitions and Duality. Different types of relations, their compositions and inverses. Different types of functions, Recursively defined functions, Recursive algorithms, generating functions and solutions of recurrence relations.	10
2	**Lattices and Propositional Logic**: Ordered Sets and Lattices: Partial order relations and Hasse diagram, Supremum and infimum, total ordering, lattices – bounded, distributive, complemented, modular, Product of lattices.Simple and compound statement. logical operators. Implication and double implication, Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers.	12
3	**Graph Theory**: Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, Matrix representation of Graphs and properties, Planar Graphs, Homeomorphism, Kuratowski's theorem,Trees, Tree Terminologies, Types of Trees: General, Binary, Strictly Binary, Full & Complete Binary Tree; Tree Traversals, Binary Search Tree, spanning trees, shortest spanning tree, Algorithms for finding shortest spanning tree Graph colorings. Four color problem.	12
4	**Algebraic Structures:**Binary operations, Semigroup, monoid, groups, subgroups,Homomorphism & Isomorphism of Groups**,** Rings, Integral domain and fields.	4
5	**Introduction to Languages**: Introduction to Languages, finite state automata grammars, finite state machines.	4
Total Lectures		42

Suggested Text Book(s):

1. Kenneth H. Rosen: Discrete Mathematics and Its Applications with combinatorics and Graph Theory), Seventh Edition, Tata McGraw Hill,2011.

2. Kolman B., Busby R., Ross S.: Discrete Mathematical Structures, Sixth Edition, Pearson Education 2009.
3. Liu, C. L.: Elements of Discrete Mathematics, Third Edition, Tata McGraw-Hill 2008.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Discrete Mathematics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	
CO-5	2	3	3	3	2	1	1	1	2	3	2	2	
Average													

FUNDAMENTAL OF PROBABILITY AND STATISTICS

COURSE CODE: 22BS1MA212
COURSE CREDITS: 4
CORE/ELECTIVE:
L-T-P : 3-1-0

Pre-requisite: Elementary Algebra and Calculus.

Course Objectives: This course gives a foundation for the basic concepts in probability theory and statistics. It will also focus on the random variable, some important probability distributions, correlation, and regression.

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand data, population and sample, classification and graphical representations of data. Compute and interpret measures of central tendency and dispersion of data.	Familiarity
CO-2	Construct sample spaces of random experiments; identify and specify events, and perform set operations on events. Compute and apply Baye's theorem to simple situations.	Familiarity
CO-3	Express the features of discrete and continuous random variables, CDF, PMF. Understand the concepts of mathematical expectation, mean, variance and MGF.	Assessment
CO-4	Understand different discrete and continuous probability distributions with applicability.	Usage
CO-5	Compute correlation coefficient and rank correlation coefficient. Understand simple linear and multiple regressions, nonlinear regression with interpretation.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Basics of Statistics:** Population, Sample, Attribute and Variable (Discrete and Continuous), Classification and Tabulation of Data. Graphical Representation of Data: Histogram, Frequency Polygon, Frequency Curve. **Descriptive statistics:** Measures of Central Tendency – Mean, Median, Mode. Dispersion and its Measures: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Skewness and Kurtosis.	10
2	**Probability:** Random Experiment, Sample Space, Event, Types of Events. Three Approaches to Probability, Additive and Multiplicative Laws Of Probability, Conditional Probability, Total Probability Theorem and Bayes' Theorem.	7
3	**Random Variables:** Introduction: Probability Mass Function (PMF), Probability Density Function (PDF) and Cumulative Distribution Function (CDF)., Mathematical Expectation, Moments of Random a Variable – Mean and Variance. Moment Generating Function of a Random Variable (Definition & Properties).	7
4	**Probability distributions:** Binomial, Poisson distribution; Uniform, Exponential, Gamma and Normal distributions.	6
5	**Correlation and Regression:** Bivariate Data, Scatter Plots. Karl Pearson's Correlation Coefficients, Spearman's Rank Correlation Coefficients, Properties of Correlation Coefficient, Curve Fitting- Method of Least squares, Simple Linear Regression, Multiple Linear Regression, Nonlinear Regression.	12
Total Lectures		42

Suggested Text Book(s):

1. Richard A. Johnson Irwin Miller and John E. Freund, ``Probability and Statistics for Engineers", PrenticeHall, New Delhi, 11th Edition, 2011.
2. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press, (2009).
3. Ronald E. Walpole , Raymond H. Myers , Sharon L. Myers and Keying E. Ye,

``Probability and statistics for engineers and scientists'', 9th Edition, Pearson, 2011.
4. Jay L. Devore, ``Probability and statistics for engineering and the sciences", Cengage Learning, 8th Edition, 2011.
5. Oliver C. Ibe, ``Fundamentals of applied probability and random processes", Academic press, 2005.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) – 10 Quizzes(2) -10 Attendance – 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Probability and Statistics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	1	1	1	3	3	3	1	4	3	4	3	**2.5**
CO-2	3	2	1	1	1	3	1	1	1	2	3	3	**1.8**
CO-3	3	2	1	3	1	1	3	1	2	3	2	3	**2.1**
CO-4	3	2	1	1	1	1	3	1	2	2	2	3	**1.8**
CO-5	3	1	1	4	3	3	3	1	4	3	4	3	**2.8**
Average	**3**	**1.6**	**1**	**2**	**1.8**	**2.2**	**2.6**	**1**	**2.6**	**2.6**	**3**	**3**	

Data Structures and Algorithms

COURSE CODE: 18B11CI211
COURSE CREDIT: 4
CORE/ELECTIVE: CORE
L-T-P : 3-1-0

Pre-requisites: C/C++

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures
5. Introduce students to data abstraction and fundamental data structures.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To gain knowledge on the notions of data structure, Abstract Data Type.	Familiarity
CO-2	For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.	Assessment
CO-3	For a given Search problem (Linear Search and Binary Search) student will able to implement it.	Assessment
CO-4	For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.	Assessment
CO-5	Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.	Assessment
CO-6	Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	7
2	Stacks: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis.	5
3	Queues: ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.	5
4	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.	8
5	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.	6
6	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.	6
7	Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	5

Total lectures	42

Suggested Text Book(s):

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press

Suggested Reference Book(s):

1. "Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
3. "Data structures and Algorithms Made Easy" 5th edition by Narasimha Karumanchi, Career monk publications
4. "Data Structureand Algorithms in C" 2nd edition by Mark Allen Weiss (2002), Pearson Education

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/106102064/
2. Link to topics related to course:
   a. https://onlinecourses.nptel.ac.in/noc18_cs25/preview
   b. https://nptel.ac.in/courses/106103069/
   c. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

Evaluation Scheme:

S.No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Data Structure and Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Averag e
CO-1	3	3	3	2	2	3	2	2	2	3	1	3	2.4
CO-2	3	3	3	2	3	2	3	2	2	3	1	3	2.5
CO-3	3	3	3	2	2	3	1	2	3	3	1	3	2.4
CO-4	3	3	3	2	3	3	2	2	3	3	1	3	2.6
CO-5	3	3	3	2	3	3	2	2	3	3	1	3	2.6
CO-6	3	3	3	2	3	3	2	2	2	3	1	3	2.5
Average	3	3	3	2	2.7	2.8	2	2	2.5	3	1	3	

Introduction to Object-Oriented Programming

COURSE CODE: 22BS1CI211
COURSE CREDITS: 4
CORE/ELECTIVE: Core
L-T-P : 3-1-0

Pre-requisite: None

Course Objectives:This course gives a foundation on applied algebra concepts, and emphasizes ….

1. To explain what constitutes an object-oriented approach to programming and identify potential benefits of Object-oriented programming over other approaches.
2. To strengthen their problem-solving ability by applying the characteristics of an object oriented approach.
3. To analyze and decompose problem specifications from Object Oriented Perspectives and represent the solution.
4. To introduce object-oriented concepts in C++.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Identify classes, objects, members of a class and the relationships among them needed to solve a specific problem	Familiarity
CO-2	Demonstrate the concept of constructors and destructors. And create new definitions for some of the operators; create function templates, overload function templates	Assessment and Usage
CO-3	Understand and demonstrate the concept of data encapsulation, inheritance, polymorphism with virtual functions	Assessment and Usage
CO-4	Demonstrate the concept of exception handling, file operations, streams in C++ and various I/O manipulators	Assessment and Usage

Course Contents:

Unit	Contents	Lectures
1.	Fundamental Concepts: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & function components, recursive functions, user -defined types, function overloading, inline functions.	10
2.	Classes and Objects: Constructors, Destructors, friend functions, Parameterized constructors, Static data members and functions, Arrays of objects, Pointers to objects, this pointer, and reference parameter, Friend Functions, Constant member functions, and Static members (static data and static member functions). Dynamic allocation of objects, copy constructors, Operator overloading using friend functions, overloading.	12
3.	Inheritance: Base Class, Inheritance and protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors and Inheritance, passing parameters to base class constructors, Granting access, Virtual base classes. Virtual function, calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.	10
4.	Exception and File Handling: Basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, I/O System Basics, File I/0: Exception handling fundamentals, Exception handling options. C++ stream classes, Formatted I/O, stream and the file classes, Opening and closing a file, Reading and writing text files.	10
Total Lectures		**42**

Suggested Text Book(s):

1. Lafore R., Object oriented programming in C++, Waite Group.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2011.
3. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill.

Suggested Reference Book(s):

1. Stroustrap B., The C++ Programming Language, Addison Wesley.
2. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2

3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Linear Algebra in Data Science and Machine Learning)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	M	M	M	M	M	L	L	L	M	M	M	M	
CO-2	M	H	H	H	H	L	L	L	M	M	L	M	
CO-3	M	M	M	M	H	L	L	L	M	M	L	M	
CO-4	M	H	H	H	M	L	L	L	M	H	M	M	
Average													

UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY

COURSE CODE: 23B11HS211

COURSE CREDITS: 3

CORE/ELECTIVE: Core L-T-P: 2-

1-0

Pre-requisite: None

Objective:

1. Development of a holistic perspective based on self-exploration about themselves (human being), Family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/ existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Self Awareness, Social awareness (family, society, nature).Sustainability in relationships and Critical thinking	Familiarity
CO-2	Introspection and self reflection	Assessment
CO-3	Sensitive to commitment towards human values, human relationship and human society.	Usage
CO-4	Developing commitment and courage	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** • Purpose and motivation for the course, recapitulation from Universal Human Values-I • Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration • Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority • Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario • Method to fulfill the above human aspirations: understanding and • living in harmony at various levels.	**7**
2	**Understanding Harmony in the Human Being - Harmony in Myself!** • Understanding human being as a co-existence of the sentient 'I'	**5**

	and the material 'Body' • Understanding the needs of Self ('I') and 'Body' - happiness and physical facility • Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) • Understanding the characteristics and activities of 'I' and harmony in 'I' • Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail • Programs to ensure Sanyam and Health.	
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** • Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship • Understanding the meaning of Trust; Difference between intention and competence • Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship • Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals • Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	**6**
4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** • Understanding the harmony in the Nature • Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature • Understanding Existence as Co-existence of mutually interacting units in all-pervasive space • Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	**5**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** • Natural acceptance of human values • Definitiveness of Ethical Human Conduct • Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order • Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. • Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and	**5**

	ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations	
	Total Lecture Hours	**28**

Suggested Text Book(s):

- Text Book 1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Suggested Reference Book(s):

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)

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Attendance - 5 Class Performance/Assignment - 10 Quiz-10

Professional Communication Practice

COURSE CODE: 23B11HS211
COURSE CREDITS: 0
CORE/ELECTIVE: CORE
L-T-P: 0-1-0

Course Objective: This course has been designed with the objective of inculcating in the students a high degree of communicative competence. It is essential for all professionals today that their talents be noticed by prospective recruiters and later on their colleagues, superiors and subordinates in the workplace. In order to standout amongst their workgroups a high degree of communicative ability goes a long way and helps them get noticed.

Course Outcomes: The following are the likely outcomes of studying the course of Professional Communication practice.

1. Improved spoken and written communication in English.
2. Develop the ability to interact effectively in the professional setting.
3. Design a good resume and be able to update it from time to time.
4. Make effective and impressive presentations using digital media.
5. Develop the confidence to perform well in interviews.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Improved spoken and written communication in English.	Familiarity
CO-2	Develop the ability to interact effectively in the professional setting.	Familiarity
CO-3	Design a good resume and be able to update it from time to time.	Assessment
CO-4	Make effective and impressive presentations using digital media	Usage
CO-5	Develop the confidence to perform well in interviews.	Assessment

Subject Code		**Semester**	2
Subject Name	Professional Communication Practice (Audit)		
Credits	0	**Contact Hours**	28

Faculty (Names)	**Coordinator(s)**	
	Teacher(s) (Alphabetically)	

Lab Exercise No.	Subtitle of the Module	Topics	Hours

	Professional Communication	An introduction to professional communication, communication skills at the workplace, intercultural communication	1
	Upper Intermediate **<u>Past continuous</u>** **(S,R&W)** **Software: Tense Buster**	The rule Practice: a love story Practice: another story Pronunciation: past or present? Practice: correct the mistakes Do you understand? Your test	1
	Upper Intermediate **<u>Conditionals (S&W)</u>** **Software: Tense Buster**	Introduction The rule Practice: would or had? Practice: complete the sentences Speaking: correct the sentences Practice: where did we go wrong? Do you understand? Vocab: referencing	1
	Upper Intermediate **<u>Adjectives & Adverbs</u>** **(S,R,W)** **Software: Tense Buster**	Introduction The rule Practice: bored or boring? Pronunciation: adjective endings Practice: how do you feel? Spot the adverb Adjective or adverb? Your test	1
	Upper Intermediate **<u>Present Perfect (R&W)</u>** **Software: Tense Buster**	Introduction The rule Practice: just, yet, for… Practice: for, since, yet… Practice: the continuous Do you understand Vocab: word groups Vocab: word groups (2) Your test	1
	Upper Intermediate **<u>Modal verbs (S,R&W)</u>** **Software: Tense Buster**	Introduction The rule Practice: make modal sentences Do you understand? Vocab: word families Your test	1
	Upper Intermediate **<u>The Future (S,R&W)</u>** **Software: Tense Buster**	Introduction Introduction (2) The rule Practice: arrangements Practice: word order Pronunciation: unstressed sounds Practice: which future form? Do you understand Your test	1
	Video and a written script on Time Management	This exercise will include showing a video and a digital script which the students are supposed to understand and make relevant notes. 1. 10 Productivity Tips and Tricks that Work by Philip Van Dusen (Run time: 6:19 mins) 2. Time Management is about more than Life Hacks – Erich C. Dierdorff (Harvard Business School) Discussion: 15 mins.	1

	Advanced **Phrasal verbs** **(L&W)** **Software: Tense Buster**	Introduction The rule Practice: phrasal verb quiz Practice: telephone verbs Pronunciation: linking Practice: word order Do you understand? Your test	1
	Journaling	Fundamentals of Journaling and Diary Writing	1
	CV/Resume writing (W)	Introduction to CV writing, difference between a CV and a Resume, samples of good CVs/Resumes and cover letters, Drafting Resumes	2
	Group Discussions (L&S)	Fundamentals of Group Discussions, Strategies for success in GDs. GD practice sessions	2
	Personal (L&S) Interview	Interviewing for employment, Types of interviews, Preparing for the personal interview. Practice session for interviews	2
	Technical Report Writing (R&W)/Technology and communication	Structure and draft short reports with date/charts, Info graphics. Technocrat personality, E-mail etiquette and Netiquette	3
	Presentation skills (L,S&W)	Making professional presentations, using effective body language, using visuals effectively.	3
	Group 1 &3 **Pronunciation** **Software: Clear Pronunciation** **(L&S)**	Connected Speech: Short Forms	1
	Group 1&3 **Stress** **Software: Clear Pronunciation** **(L&S)**	Word Stress: Recognizing stress in words	1
	Group 1 **(R&W)**	Thought Projection and Expression	2
	Group 1 **(R&W)** **Description of the video content vis-à-vis the dynamics of the situation**	A description of the contents of the video with special focus on implied meaning in the tone of voice, body language of the people appearing in the video.	2
	Group 2&4 **(R&W)** **Unseen Comprehension**	Comprehension passages will be given that needs to be evaluated correctly to answer the questions.	1
	Group 2&4 **Advanced Past perfect** **(L,S&W)** **Software: Tense Buster**	Knowledge and usage of tenses	1
	Group 2 &4 **Book Review** **(R&W)**	Writing a book review on any book and sharing it in class.	2
	Group 2 **Summary/Precis Writing on particular articles or research papers**	Writing a summary or precis of an article or research paper such that the reader gets a clear idea of the original script.	2
	Group 3 **Software: Clear Pronunciation (L&S)**	Connected Speech: Joining to a Vowel	1
	Group 3 **Software: Clear Pronunciation (L&S)**	Connected Speech: Joining Consonants	1
	Group 3 **Software: Clear Pronunciation (L&S)**	Connected Speech: Disappearing Sounds	1
	Group 4 **Business Vocabulary (S&W)**	Increasing the usage of appropriate vocabulary	2

Total 22 hours of common activity and 6 hours variable activities per group which makes a total of 28 hours	**39**

Note: Group Formation is based on English Level Proficiency (Diagnostic Test)

Methodology

The course follows a lab based teaching-learning method with classroom discussions and activities on fundamental concepts of grammar with a strong emphasis on skill development of students with regard to speaking, writing, logically interpreting ideas into words and reasoning in the classroom. The exercises are solved by the students on the softwares and the marking is automatically recorded in lab. In Tutorial classes the students are assessed on their learning and performance of any given task/exercise. They learn to structure their communication to the requirements of the recruiters and later the organizations they will be working for. Thus professional communication extends to learning how to write a good resume, performing well in all types of interviews and group discussion and also to make effective presentations.

Evaluation: Each of the class activities have a score allotted to them. These scores add up to give the final marks in the course.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
	Teaching Assessment	100	Entire Semester	Tutorial and Lab activities

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	1	2	2	2	1	3	1	1	1	3	2	3	1.83
CO2	1	2	2	2	1	3	1	1	3	3	2	3	2
CO3	0	0	0	1	1	3	0	1	1	3	0	2	1
CO4	1	2	1	2	2	3	1	0	3	3	2	2	1.83
CO5	0	0	1	2	1	3	0	0	2	3	1	3	1.33
Average	0.6	1.2	1.2	1.8	1.2	3	0.6	0.6	2	3	1.4	2.6	1.6

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition,Publisher, Year of Publication etc. in IEEE format)	
1.	Bill Mascull, Business Vocabulary in use, 2nd ed., Cambridge University Press, 2002.

2.	*Ken Blanchard,PhD, Spencer Johnson, MD, The one Minute Manager, Harper Collins Publishers, 2011*

Relevant Links:

1. Business English Communication
https://nptel.ac.in/courses/109/106/109106129/#
2. Developing soft skills and Personality
https://nptel.ac.in/courses/109/104/109104107/
3. Employment Communication Lab
https://nptel.ac.in/courses/109/105/109105144/
4. Speaking Effectively
https://nptel.ac.in/courses/109/105/109105117/
5. Technical English for Engineers
https://nptel.ac.in/courses/109/106/109106094/

Environmental Studies

COURSE CODE: 23B11GE411

COURSE CREDITS: 2

CORE/ELECTIVE: Mandatory Course

L-T-P: 2-0-0

Pre-requisite: None

Course Objectives:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population- economic growth, energy requirement and demand.
3. Analyze material balance for different environmental systems
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development.
6. Recognizing the major concepts of environmental studies, developing problem solving ability, forecasting the global climate change

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject	Familiarity
CO-2	Understanding ecosystem services and its functioning as well as equitable use of natural resources.	Assessment
CO-3	Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples.	Assessment
CO-4	Correlating the concept of Biodiversity and its importance to human mankind	Usage
CO-5	Understanding social issues and their impact on the environment.	Usage
CO-6	Role of Information Technology in environment and human health	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Unit 1: Multidisciplinary nature of environmental studies:** The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles. Ecolabeling /Ecomark scheme	4
2	**Unit 2: Natural resources, their consumption & Protection:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources. Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	5
3	**Unit 3: Pollution- a threat to environment:** Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains	5
4	**Unit 4: Environmental standards & Quality:** Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its applications	4
5	**Unit 5: Biodiversity and its conservation:** Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity	4
6	**Unit 6: Social Issues and the Environment:** Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. Water conservation, rain water harvesting, watershed management. Major International organizations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC)	4
7	**Unit 7: Environmental Management:** Environment protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in the enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities Environmental management system. Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment. Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability;	4

8	**Case studies and fieldwork based upon projects**: The students are expected to be engaged in some of the following or similar identified activities: • Discussion on one national and one international case study related to the environment and sustainable development. • Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report. • Documentation of campus biodiversity/Documentation of local biodiversity. • Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.	**Self study hours (recommended 2 hours /week)***
Total lectures		**30**

*** Formal instructions /Guidance related to the project topics**

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses - Erach Bharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.
2. Chiras D D.(Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones & Barlett Publishers.
3. David Laurance. 2003. Environment Impact assessment, Wiley publications.
4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, NewDelhi .

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. https://nptel.ac.in/courses/120108002/
4. https://nptel.ac.in/courses/120108005
5.https://www.ugc.ac.in/pdfnews/1084504_Draft-Guidelines-and-Curriculum-Framework-for-Environment-Education-at-UG-level.pdf

Data Structures and Algorithms-Lab

COURSE CODE: 18B17CI271
COURSE CREDITS: 2
CORE/ELECTIVE: CORE
L-T-P : 0-0-4

Pre-requisites: None

Course Objectives:

1. Develop problem solving ability using Programming
2. Develop ability to design and analyze algorithms
3. Introduce students to data abstraction and fundamental data structures
4. Develop ability to design and evaluate Abstract Data Types and data structures
5. Apply data structure concepts to various examples and real life applications

Course outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To gain knowledge on the notions of data structure, Abstract Data Type	Familiarity
CO-2	To have hands on skills to evaluate different kinds of linked lists and their applications in day-to-day problem solving.	Usage
CO-3	To have hands on skills to evaluatedifferent kinds stacks and their applications and implementations in day-to-day problem solving	Assessment
CO-4	To have hands on skills to evaluate different kinds queues and their applications and implementations in simulations.	Assessment
CO-5	To acquire knowledge of various sorting algorithms	Usage
CO-6	To learn Searching: Balanced tree, red-black tree, lower bounds for searching	Usage
CO-7	To learn to code for operations on Tree or BST (Creation; Traversing like pre-order, post-order and in-order; Searching element; finding height etc.)	Usage
CO-8	Introduction to Heaps	Usage
CO-9	To learn to code for operations on Graphs (Creation; entering info, printing output and deleting; traversal of BFS and DFS algorithm)	Assessment

List of Experiments:

S.No.	Description	Hours
1	Getting acquainted with a) Arrays and Strings, Structures, b) Recursion, Pointers c) Dynamic memory allocation	 2 4 4
2	Operations on: (Creation, insertion, deletion, sorting, traversing, reversing etc) a) Linear Linked List, b) Doubly and c) Circular Linked List	 4 4 2
3	Operations on Stacks: a) Creation; pushing; popping; b) testing underflow, overflow; c) prefix and postfix	 4 2 2
4	Operations on Queues: a) Creation; b) enqueue; dequeue; c) testing underflow, overflow	 4 2 2
5	Operations on Tree or BST: Creation; a) Traversing like pre-order, post-order and in-order; b) Searching element; finding height etc.	 4 2

6	Implementation of sorting algorithms 1: Insertion Sort and Selection Sort Algorithm with arrays using dynamic memory allocation.	2
7	Implementation of sorting algorithms 2: Bubble Sort and Merge Sort Algorithm with arrays using dynamic memory allocation.	2
8	Implementation of sorting algorithms 3: Implementation of Radix Sort and Quick Sort Algorithm with arrays using dynamic memory allocation.	2
9	Operation on Heaps: a) Heaps, b) Heap Sort	 2 2
10	Implementation of Searching algorithms: Linear Search Algorithm and Binary Search Algorithm using dynamic memory allocation.	2
11	Operations on Graphs: (Creation; entering info; printing Output and deleting; traversal of BFS and DFS algorithm etc.)	2
Total Lab hours		**56**

Minor Project(s) – (*Only for 2 credit lab)*

- Design GUI based program to solve any binary equation.
- Design GUI based program to find the roots of quadratic equation.
- Design a program that picks the characters at equal interval from the given text/paragraph and generate a new paragraph in which each set of word can't have more than 4 characters. Last word of the paragraph can have <=4 characters.
- Program to input following data into disk file. Code, name, department and salary of employee in a firm. After creating file read the file and find following-
  Methodology algorithms Code execution Future scope
  Count number of employees as per
  department Search record of employee
  Display record of employee
  Display list of employees in alphabetical order as per
  department Read record from file

Suggested Books/Resources:

1. Langsam, Augestein, Tenenbaum: Data Structures using C and C++, 2nd Edn, 2000, Horowitz and Sahani: Fundamental of Data Structures in C, 2 Edn, 2008
2. Weiss: Data Structures and Algorithm Analysis in C/C++, 3rd Edn, 2006
3. Sahani: Data Structures, Algorithms and applications in C++, 1997.
4. Corman et al: Introduction to Algorithms, 3rd Edn., 2009
5. http://www.nptel.iitm.ac.in/video.php?subjectId=106102064, last accessed Mar 13, 2014.
6. http://www.cs.auckland.ac.nz/~jmor159/PLDS210/ds_ToC.html, last accessed Mar 13, 2014.
7. http://courses.cs.vt.edu/csonline/DataStructures/Lessons/index.html, last accessed Mar 13, 2014.
8. Link to topics related to course:
   a. http://cse.iitkgp.ac.in/~pallab/pds16/pds16.htm
   b. https://onlinecourses.nptel.ac.in/programming101/preview

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO-1	3	2	3	2	2	3	3	3	2	3	2	2	2.5

CO-2	3	3	3	2	3	3	3	3	2	3	2	3	2.8
CO-3	3	3	3	2	2	3	3	3	3	3	2	2	2.7
CO-4	3	3	3	3	3	3	3	2	2	3	3	3	2.8
CO-5	3	3	3	2	2	2	3	3	3	3	2	2	2.6
CO-6	3	3	3	3	3	3	3	2	2	3	3	3	2.8
CO-7	3	3	3	3	3	3	2	2	3	3	3	3	2.8
CO-8	3	3	3	2	3	3	3	3	3	3	2	3	2.8
CO-9	3	3	2	3	3	3	3	3	3	2	3	3	2.8
Average	3	2.9	2.9	2.4	2.7	2.9	2.9	2.7	2.6	2.9	2.4	2.7	

Introduction to Object-Oriented Programming Lab

COURSE CODE: 22BS7CI271
COURSE CREDITS: 1 (L-0 T-0 P-2)
CORE/ELECTIVE: Core

Pre-requisite: None

Course Objectives: This course gives a foundation on applied algebra concepts, and emphasizes ….

1. To explain what constitutes an object-oriented approach to programming and identify potential benefits of Object- oriented programming over other approaches.
2. To strengthen their problem-solving ability by applying the characteristics of an object-oriented approach.
3. To analyze and decompose problem specifications from Object Oriented Perspectives and represent the solution.
4. To introduce object-oriented concepts in C++.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO 1	To learn the concepts of Objects, Classes, Methods, Constructors and Destructors.	Usage
CO 2	To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.	Usage
CO 3	To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance and Hybrid Inheritance.	Usage
CO 4	To learn the concept of Abstract classes.	Usage
CO 5	To learn the concepts of Operator overloading and conversion function	Usage
CO 6	To learn the Exception Handling: try --catch and finally block, making user defined exceptions.	Usage
CO 7	To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.	Usage

List of Experiments:

S. No.	Description	Hours
1.	Write a program that uses a class where the member functions are defined inside a class.	2
2.	Write a program that uses a class where the member functions are defined outside a class.	2
3.	Write a program to demonstrate the use of static data members.	2
4.	Write a program to demonstrate the use of const data members.	2
5.	Write a program to demonstrate the use of zero argument and parameterized constructors.	2
6.	Write a program to demonstrate the use of dynamic and explicit constructor.	2
7.	Write a program to demonstrate the overloading of increment and decrement operators.	2
8.	Write a program to demonstrate the overloading of memory management operators.	2
9.	Write a program to demonstrate the use of conversion function.	2
10.	Write a program to demonstrate usage of abstract classes.	2
11.	Write a program to demonstrate the multiple inheritances.	2
12.	Write a program to demonstrate the runtime polymorphism.	2
13.	Write a program to demonstrate the exception handling.	2

14.	Write a program to demonstrate the reading and writing of mixed type of data.	2
Total Lab Hours		**28**

Suggested Text Book(s):

1. Lafore R., Object oriented programming in C++, Waite Group.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2011.
3. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill.

Suggested Reference Book(s):

1. Stroustrap B., The C++ Programming Language, Addison Wesley.
2. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.

EvaluationScheme:

S. No.	Exam	Marks
1.	Mid Sem. Evaluation	20 Marks
2.	End Sem. Evaluation	20 Marks
3.	Attendance	15 Marks
4.	Lab Assessment	45 Marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO / PO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO 1	H	H	M	M	M	M	L	L	M	M	M	M	
CO 2	H	H	H	H	H	L	L	L	M	M	L	M	
CO 3	H	H	M	M	H	L	L	L	M	M	L	M	
CO 4	H	H	H	H	M	L	L	L	M	H	M	M	
CO 5	H	H	H	H	H	H	M	M	H	H	H	H	
CO 6	H	H	H	H	H	H	M	M	H	H	H	H	
CO 7	H	H	H	H	H	H	M	M	H	H	H	H	
Average													

Introduction to Numerical Computing

COURSE CODE: 24BS1MA311

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Course Objectives: On successful completion of this course, a student will be able to

- Understand theoretical and practical aspects of a relatively wide spectrum of numerical techniques and familiarize the students with numerical coding.
- Demonstrate knowledge and understanding of numerical methods to solve nonlinear equations, and systems of linear equations, to compute quadrature and to solve ordinary and partial differential equations.
- Analyze mathematical problems with multidisciplinary applications and determine suitable numerical techniques to solve them.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Ability to find roots of nonlinear-transcendental equations using various numerical techniques with convergence	Familiarity & Assessment
CO-2	Ability to solve a system of simultaneous linear equations using direct and iteration methods involving applications to matrices	Assessment
CO-3	Deduce the interpolating polynomials of appropriate kind and apply them in interpolating a given data	Familiarity & Usage
CO-4	Apply the methods of numerical differentiation in finding derivatives and learn the methods of numerical integration in solving problems	Familiarity & Usage

Course Contents:

Unit	Contents	Lectures required
1	**Non-linear equations**: Introduction to error analysis; relative error, truncation error, order of approximation, order of convergence, transcendental and polynomial equations, iterative methods, bisection method, secant method, method of false position, Newton-Raphson method, fixed point iteration, convergence analysis and order of convergence for all these methods.	**11**
2	**Numerical Linear Algebra:** Matrices and linear system of equations: LU-decomposition method for solving systems of equations, Singular value decomposition, symmetric positive definite matrices, iterative algorithms for linear equations - Gaussian elimination method, Gauss-Jordan, Gauss-Jacobi method, Gauss-Seidel method, ill and well-conditioned systems, Rayleigh's power method for eigen-values and eigenvectors	**11**
3	**Interpolation:** Polynomial interpolation, Newton-Gregory, Stirling's, Bessel's, and Lagrange's interpolation formula, Newton's divided differences interpolation formulae with error analysis, curve-fitting- weighted least square approximation, method of least square for continuous functions.	**10**

4	**Numerical Differentiation and Integration:** Numerical differentiation and errors in numerical differentiation, Newton-Cotes formulae, trapezoidal rule, Simpson's rule, Gaussian integration. numerical solutions of ordinary differential equations: Picard's and Taylor's series, Euler's and Runge-Kutta's (RK) methods.	**10**
	Total Lectures	**42**

Suggested Text Book(s):

1. M. K. Jain, R. K. S. Iyengar, and R. K. Jain, "Numerical Methods: Problems and Solutions", New Age International, 3rd Edition, 2020.
2. S. S. Sastry, "Introductory methods of numerical analysis", PHI, 5th Edition, 2012.

Suggested Reference Book(s):

1. Richard L Burden, J Douglas Faires, "Numerical Analysis", 9th revised Edition, Cengage Learning, Inc, 2010.
2. Kendall E. Atkinson, "An Introduction to Numerical Analysis", 2nd Edition, Wiley India Private Limited, 2008.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignments (2) - 08 Quizzes (3) -12 Attendance -05

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Introduction to Numerical Computing)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	2	2	2	1	2	1	2	2	2	2	**1.9**
CO-2	2	3	2	3	2	1	2	1	2	2	2	2	**2**
CO-3	2	2	3	2	2	1	2	1	2	2	2	2	**1.9**
CO-4	3	3	3	3	2	1	2	1	2	3	3	2	**2.3**
Average	**2.5**	**2.5**	**2.5**	**2.5**	**2**	**1**	**2**	**1**	**2**	**2.2**	**2.2**	**2**	

Real Analysis and Differential Equations

COURSE CODE: 24BS1MA312

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Course Objectives: On successful completion of this course, a student will be able to

- Learn the convergence methods for real sequences and infinite series.
- Understand the basic theory of ordinary and partial differential equations and solve ordinary and partial differential equations.
- Use different approaches to solve differential equations occurring in engineering and physical sciences by using one or a combination of different methods.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the process of convergence of sequence and series	Assessment
CO-2	Method of undetermined Coefficients, Variation of Parameters to find the solutions of Higher Order Linear Differential Equations with constant coefficients.	Assessment & Usage
CO-3	Understand the Laplace transform & its properties and apply the Laplace transform to solve differential equations.	Assessment & Usage
CO-4	Evaluate partial derivatives with its physical significance and expand functions of several variables. Find maxima and minima of functions of several variables with / without constraints. Find areas and volumes of solids using multiple integration.	Familiarity & Assessment
CO-5	Understanding partial differential equations (PDEs) and solving linear/nonlinear PDEs with fundamental techniques	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Sequence and Series of Real Numbers:** Convergence of sequences, bounded and monotone sequences, Cauchy sequences, Bolzano - Weierstrass theorem, absolute convergence, tests of convergence for series – comparison test, ratio test, root test; Power series (of one real variable), radius and interval of convergence, term-wise differentiation and integration of power series.	**10**
2	**Differential Equations:** Review of differential equations, Higher-order linear differential equations: basic existence theorem, homogeneous equation, Wronskian, reduction of order, non-homogeneous equation, homogeneous linear equation with constant coefficients, Cauchy-Euler equation, method of variation of parameters.	**10**

3	**Laplace Transformation:** Definition, basic properties, Laplace transforms of some common functions, shifting theorems, change of scale property, Laplace transforms of derivatives and integrals, inverse Laplace transforms, Dirac-delta function, unit step function, convolution theorem and solving IVP's with Laplace transforms.	**8**
4	**Multivariable Calculus**: Limit, continuity, partial derivatives, maxima and minima. double integrals, change of order of integration, application of double integrals.	**8**
5	**Introduction of Partial Differential Equations:** Order and degree of partial differential equations, concept of linear and non-linear partial differential equations, formation of first order partial differential equations, Lagrange's method, Charpit's method.	**6**
	Total Lectures	**42**

Suggested Text Book(s):

1. Bartle, R.G. & Sherbert, D.R. : Introduction to Real Analysis, Wiley, 4th Edition
2. Simmons, G.F. : Differential Equations with Applications, McGraw Hill

Reference Book (s):

1. Goldberg , R. R. : Methods of Real Analysis, Oxford and IBH Publishing, 5th Reprint

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 08 Quizzes (3) -12 Attendance - 05

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Real Analysis and Differential Equations)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	2	2	2	1	2	1	2	2	2	2	**1.9**
CO-2	2	3	2	3	2	1	2	1	2	2	2	2	**2**
CO-3	2	2	3	2	2	1	2	1	2	2	2	2	**1.9**
CO-4	3	3	3	3	2	1	2	1	2	3	3	2	**2.3**
CO-5	2	3	2	3	2	1	2	1	3	2	3	2	**2.1**
Average	**2.4**	**2.6**	**2.4**	**2.6**	**2**	**1**	**2**	**1**	**2**	**2.1**	**2.4**	**2**	

LIFE SKILLS AND INTERPERSONAL DYMANICS

COURSE CODE: 23B11HS311

COURSE CREDITS: 3

CORE/ELECTIVE: CORE L-T-P: 2-1-0

Pre-requisite: None

Course Objectives:

Course Outcomes:

S.No	Course Outcomes	Level of Attainment
CO-1	Understand the fundamentals of human Behavior and its determinants.	Familiarity
CO-2	Understand the meaning of personality and be able to classify individuals into different personality types	Assessment
CO-3	Understand attitude and its relationship with personality and behavior.	Assessment
CO-4	Understand motivation and its importance in work and life	Assessment
CO-5	Analyze interpersonal dynamics of groups and teams and develop Emotional Intelligence	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Understanding Interpersonal dynamics** and its importance in personal and professional life. Self-Esteem and Self-Confidence, Self-Motivation ,Self-Awareness and Goal Setting; Emotional Intelligence, Perception,	4
2	**Personality**. The MBTI framework, The Big Five.	2
3	**Attitude** and its determinants. Relationship between attitude and behavior. Importance of attitude in the workplace.	2

4	**Stress Management**, Cause and effect of stress, coping with stress, values associated to positive stress management	**2**
5	**Theories of motivation**: Maslow's need hierarchy, Herzberg's two factor theory, Behavioral theories and contingency theories.	**3**
6	**Leadership**: Trait, Behavioral and contingency theories of leadership. Charismatic leader, transactional and transformational leadership.	**4**
7	**Dynamics of Group Behavior**: forming groups, converting groups to teams and managing team dynamics	**4**
8	**Emotional intelligence**: Definition, measurement and development of emotional intelligence	**3**
9	**Problem Solving & decision making**: Steps in problem solving, Decision making, Models of Decision Making, Creativity and Critical thinking, Analytical thinking.	**2**
10	**Social and Negotiation Skills, Conflict Management**	**2**
Total lectures		**28**

Suggested Text Book(s):

1. Greenberg Jerald and Baron Robert A.: Behavior in Organizations: Understanding and Managing The Human Side of Work, Prentice Hall of India,2022
2. Stephen P. Robbins, Timothy A. Judge: Organizational Behavior, Pearson Education,2018

Suggested Reference Book(s):

1. Mc Shane L. Steven, Glinow Mary Ann Von & Sharma Radha R. – Organizational Behaviour,Tata McGraw Hill.2006
2. Newstrom John W.: Organisational Behaviour, Tata McGraw Hill,2001

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2

3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Sr No	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	0	2	1	3	2	3	3	3	3	3	0	3	2.1
CO-2	0	2	3	3	2	3	3	3	3	3	0	3	2.3
CO-3	0	2	1	3	2	3	3	3	3	3	0	3	2.1
CO-4	0	2	1	3	2	3	3	3	3	3	2	3	2.3
CO-5	0	2	3	3	2	3	3	3	3	3	2	3	2.4
Average Score	**0**	**2**	**1.8**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**0.8**	**3**	

Database Management Systems

COURSE CODE: 18B11CI313

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: Introduction to Computer Programming, Discrete Mathematics, Data Structures

Course Objectives:

1. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
2. To understand and use data manipulation language to query, update, and manage a database.
3. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
4. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Explain the characteristics, architecture of database approach, its components, different data models and the examples of their usage.	Familiarity
CO-2	For a given query write relational algebra expressions for that query and optimize the developed expressions.	Usage
CO-3	For a given specification of the requirement, design the databases using E-R method and normalization.	Usage
CO-4	Determine the functional dependency between two or more attributes, compute the closure of a set of attributes, evaluate a proposed decomposition	Assessment
CO-5	Give examples of the application of primary, secondary, and clustering indexes, explain the theory and application of internal and external hashing techniques.	Assessment
CO-6	Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.	Assessment
CO-7	Familiarize with the security in databases and gaining familiarity with other popular databases used in the industry	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	5
2	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS -	15

	MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	
3	**Storage strategies:** Indices, B-trees, hashing.	**6**
4	**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	**9**
5	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	**5**
6	**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	**3**
Total lectures		**42**

Suggested Text Book(s):

1. "Fundamentals of Database Systems" Elmasri, Navathe, Pearson Education.
2. "Database system concepts" Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill Ellis

Suggested Reference Book(s):

1. "Database Systems: A Practical Approach to design, Implementation and Management". Thomas Connolly, Carolyn Begg; Third Edition, Pearson Education.
2. Bipin C Desai, ?An Introduction to Database Systems?, Galgotia. Publications Pvt Limited, 2001
3. "An Introduction to Database Systems", C.J.Date, Pearson Education.
4. "A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson, Education.
5. "Data Management: databases and organization", Richard T. Watson, Wiley.
6. " Data Modeling Essentials", Graeme C. Simxion, Dreamtech.

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Other useful resource(s):

1. Link to NPTEL course contents: https://www.youtube.com/watch?v=EUzsy3W4I0g&list=PL9426FE14B809CC41
2. Link to topics related to course:
   - **a.** https://www.tutorialspoint.com/dbms/database_normalization.htm
   - **b.** https://www.igi-global.com/journal/journal-database-management/1072
   - **c.** https://www.tutorialspoint.com/dbms/dbms_hashing.htm

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination

1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Internal Assessment	25	Entire Semester	Assignment Quizzes Attendance

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Database Management Systems)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	3	3	2	1	2	2	2	1	2	3	3	2	**2.2**
CO-2	3	3	3	2	2	2	3	2	2	1	2	2	**2.3**
CO-3	3	3	2	1	1	3	3	3	3	3	1	1	**2.3**
CO-4	3	2	3	1	2	2	2	2	1	2	1	2	**1.9**
CO-5	3	2	2	1	2	3	3	2	1	3	2	1	**2.1**
CO-6	3	2	3	1	1	3	2	1	1	3	2	1	**1.9**
CO-7	3	3	2	1	1	3	3	1	3	3	3	1	**2.3**
Average	**3**	**2.6**	**2.4**	**1.1**	**1.6**	**2.6**	**2.6**	**1.7**	**1.9**	**2.6**	**2**	**1.4**	

Python Programming Essentials

COURSE CODE: 18B11CI314

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. Provide an understanding of the role computation can play in solving problems.
2. Help students, including those who do not plan to major in Computer Science and Electrical Engineering (like BI and BT), feel confident of their ability to write small programs that allow them to accomplish useful goals.
3. Position students so that they can compete for research projects and excel in subjects with programming components.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.	Familiarity
CO-2	Broaden the knowledge about Branching and Iteration. To have hands on skills on String Manipulation, Guess and Check, Approximations, Bisection	Assessment
CO-3	To learn about Decomposition Abstractions, Tuples, Lists, Dictionaries and Illustrative programs:	Assessment
CO-4	Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:	Usage
CO-5	Understanding and analyzing Object Oriented Programming:	Familiarity
CO-6	To have hands on skills on Illustrative programs(examples Sorting and Searching, Regular expressions) and GUI	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Informal introduction to Python programming language:** What is a program?, What is debugging?, Formal and natural languages, Downloading and installing Python., The first program, Debugging **Variables, expressions and Functions in Python** Values and types, Variables, Variable names and keywords, Operators and operands, Expressions and statements, Interactive mode and script mode, Order of operations, String operations, Function calls, Type conversion functions, Math functions, Composition, Adding new functions, Definitions and uses, Flow of execution **Parameters and arguments**	5
2	**Branching and Iteration:** Loops, Multiple assignment, Updating variables, The while statement, Break **String Manipulation, Guess and Check, Approximations, Bisection:** String manipulation, Guess and check algorithms(e.g: find Square Root etc), Approximate solutions(e.g Successive approximation), Bisection method.	8

3	**Decomposition, Abstractions:** divide and conquer (modules), Abstraction **Tuples, Lists, Dictionaries, Illustrative programs:** - Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; - Tuples: tuple assignment, tuple as return value; - Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram	**7**
4	**Files, Modules, Packages**: Files and exception: text files, reading and writing files, format operator, Packages, Illustrative programs: word count, copy file. **Testing, Debugging, Exceptions, Assertions:** Unit testing framework(unit test), debugger for Python program(pdb), Handling an exception	**7**
5	**Object Oriented Programming:** -Classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects -OOP, continued: inheritance, polymorphism, operator overloading, abstract classes.	**7**
6	**Illustrative programs(examples):** • Sorting and Searching • Regular expressions o Match function o Search function o Matching vs. Searching o Modifiers o Patterns **GUI :** Introduction, Tkinter programming, Tkinter widgets	**8**
Total lectures		**42**

Suggested Text Book(s):

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978- 1111822705

Suggested Reference Book(s):

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705.
2. Chun, Wesley. Core python programming. Vol. 1. Prentice Hall Professional, 2001.
3. Zelle, John M. Python programming: an introduction to computer science. Franklin, Beedle & Associates, Inc., 2004.
4. Gold, Steve. "Python: Python Programming Learn Python Programming In A Day-A Comprehensive Introduction To The Basics Of Python & Computer Programming." (2016).

Other useful resource(s):

1. https://onlinecourses.nptel.ac.in/noc18_cs35/preview
2. https://nptel.ac.in/courses/106106145/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-

0001-introduction- to-computer-science-and-programming-in-python-fall-2016/index.htm

4. https://docs.python.org/3/tutorial/index.html

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	*T-1	15	1 Hour.	Syllabus covered up to T-1
2	#T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	$T-3	35	2 Hours	Entire Syllabus
4.	~Internal Assessment	25	Entire Semester	Assignment Quizzes Attendance

*In Test-I Paper the 20% of 15 Marks will be allocated to Introduction to Computers portion and 80% of 15 Marks will be allocated to Introduction to Programming portion.

#In Test-II Paper the 20% of 25 Marks will be allocated to syllabus of Test-I and 80% of 25 Marks will be allocated to further covered portion.

$In Test-III Paper the 40% of 30 Marks will be allocated to syllabus of Test-I+ Test-II and 60% of 30 Marks will be allocated to further covered portion.

~Internal Assessment will purely be focused on the assignments and quizzes based on Python Programming.

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Python Programming Essentials)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	3	1	2	3	3	2	1	1	1	3	**2.1**
CO-2	3	3	3	1	2	3	3	3	2	1	1	3	**2.3**
CO-3	3	3	3	1	2	3	2	3	2	1	1	3	**2.3**
CO-4	3	3	3	3	3	3	3	2	2	1	1	3	**2.5**
CO-5	3	3	3	2	2	3	3	3	2	1	1	3	**2.4**
CO-6	3	3	3	2	3	2	3	2	2	1	1	3	**2.3**
Average	**3**	**2.8**	**3**	**1.7**	**2.3**	**2.8**	**2.8**	**2.5**	**1.8**	**1**	**1**	**3**	

Database Management Systems Lab

COURSE CODE: 18B17CI373

COURSE CRDITS: 2

CORE/ELECTIVE: CORE

: 0-0-4

Pre-requisite: None

Course Objectives:

1. Develop the ability to design, implement and manipulate databases.
2. Introduce students to build database management systems.
3. Apply DBMS concepts to various examples and real life applications.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Design and implement a database schema	Usage
CO2	Design different views of tables for different users and to apply embedded and nested queries	Usage
CO3	Understand the use of structured query language and its syntax , transactions, database recovery and techniques for query optimization	Familiarity
CO4	Understand , analyze and apply common SQL statements including DDL , DML , DCL statements to perform different operations	Assessment & Usage
CO5	Develop application programs using PL/SQL	Usage
CO6	Design and implement a project using embedded SQL and GUI	Usage

List of Experiments

S.No	Description	Hours
1	To implement Data Definition language commands Create database/table, alter, drop, truncate	**2**
2	To implement Constraints as a part of Data Definition language Primary key, Foreign Key, Check, Unique	**2**
3	To implement Constraints as a part of Data Definition language Null, Not null, Default, Enable Constraints, Disable Constraints, Drop Constraints	**2**
4	To implement Data Manipulation Language Commands Insert, Select, Update, Delete	**2**
5	To implement Data Control Language, Transfer Control Language Commands commit, rollback, save point, grant, revoke	**2**
6	To practice in Built Functions Date functions, numerical functions, character functions, conversion functions, group functions, count functions etc.	**2**
7	To practice group by, having clause and special operators such as between, like, in etc.	**2**
8	To practice Nested Queries	**2**
9	To practice Nested Queries and Join Queries Inner join, Left join, Right join, Full join	**2**
10	To implement Set Operators Union, Intersect, Minus	**2**
11	To implement Views	**2**
12	To implement and practice PL/SQL control structure If, if then else, else if, nested if	**2**

13	To implement and practice PL/SQL control structure For loop, while loop	**2**
14	To implement and practice PL/SQL procedures	**2**
15	To implement and practice PL/SQL functions	**2**
16	To implement triggers	**2**
17	To study about various Visual Basic (front end) tools	**2**
18	To design and implement forms using visual basic	**2**
19	To design and implement a menu design using Visual Basic	**2**
20	To implement report generation using VB.	**4**
21	To create a database for payroll processing system using SQL	**4**
22	Implement the above created database using VB.	**4**
23,24,25	**Minor Projects – (Only for 2 credit lab)** Banking System University System Company System Hospital Management System Passport Automation System	**6**
Total Lab hours		**56**

Suggested Books/Resources:

1. "Fundamentals of Database Systems" Elmasri, Navathe, Pearson Education.
2. “Database system concepts” Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill
3. “Database Systems: A Practical Approach to design, Implementation and Management”. Thomas Connolly, Carolyn Begg; Third Edition, Pearson Education.
4. Bipin C Desai, ?An Introduction to Database Systems?, Galgotia. Publications Pvt Limited, 2001
5. “An Introduction to Database Systems”, C.J.Date, Pearson Education.
6. “A first course in Database Systems”, Jeffrey D. Ullman, Jennifer Windon, Pearson, Education.
7. Orcacle manual
8. Link to topics related to course:
   a. https://www.youtube.com/watch?v=EUzsy3W4I0g&list=PL9426FE14B809CC41
   b. https://www.w3schools.com/sql/
   c. https://www.codementor.io/collections/learn-sql-bwclmlodl

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	2	2	2	2	2	1	2	3	3	1	**2.2**
CO2	3	1	3	2	2	2	3	2	2	3	2	2	**2.3**
CO3	3	3	2	1	1	3	3	3	3	3	1	1	**2.3**
CO4	3	2	2	2	2	2	2	2	1	2	1	1	**1.8**
CO5	3	3	2	1	2	3	3	2	1	2	2	1	**2.1**
C06	3	3	2	1	1	3	3	1	3	3	3	1	**2.3**
Average	**3**	**2.5**	**2.2**	**1.5**	**1.7**	**2.5**	**2.7**	**1.8**	**2**	**2.7**	**2**	**1.2**	

Python Programming Lab

COURSE CODE: 18B17CI374

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

L-T-P: 0-0-4

Pre-requisite: None

Course Objectives:

1. Learn syntax, semantics and create Functions in Python.
2. Understand the usage of Lists, Dictionaries, and arrays in Python.
3. Learn the Implementation of object oriented programming concepts in Python
4. Learn different data structure in Python.
5. Understand file handling in Python
6. Implement GUI applications and browser.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.	Familiarity
CO2	Broaden the knowledge about Branching and Iteration. To have hands on skills on String Manipulation, Guess and Check, Approximations, Bisection	Assessment
CO3	To learn about Decomposition Abstractions, Tuples, Lists, Dictionaries and Illustrative programs:	Assessment
CO4	Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:	Usage
CO5	Understanding and analyzing Object Oriented Programming:	Familiarity
CO6	To have hands on skills on Illustrative programs(examples Sorting and Searching, Regular expressions) and GUI	Usage

List of Experiments

S.No.	Description	Hours
1	1. Write a Python program to get the Python version you are using. 2. Write a Python program which accepts the radius of a circle from the user and compute the area.	**2**
2	1. Write a Python program to display the current date and time. 2. Write a Python program which accepts the radius of a circle from the user and compute the area.	2
3	1. Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them. 2. Write a Python program to display the first and last colors from the following list. color_list = ["Red","Green","White" ,"Black"].	2
4	1. Write a Python program to print the documents (syntax, description etc.) of Python built-in function(s). Samplefunction :abs() ExpectedResult : abs(number)->number Return the absolute value of the argument.	2
5	Write a Python program to get the difference between a given number and 17, if the number is greater than 17 return double the absolute difference. Write a Python program to test whether a number is within 100 of 1000 or 2000.	2

	Write a Python program to check whether a specified value is contained in a group of values. Test Data : 3 -> [1, 5, 8, 3] : True -1 -> [1, 5, 8, 3] : False	
6	Write a Python program to print all even numbers from a given numbers list in the same order and stop the printing if any numbers that come after 237 in the sequence. Sample numbers list : numbers = [386, 462, 47, 418, 907, 344, 236, 375, 823, 566, 597, 978, 328, 615, 953, 345, 399, 162, 758, 219, 918, 237, 412, 566, 826, 248, 866, 950, 626, 949, 687, 217, 815, 67, 104, 58, 512, 24, 892, 894, 767, 553, 81, 379, 843, 831, 445, 742, 717, 958,743, 527] Now do it using file as input.	**2**
7	Write a Python program that accepts a single integer value entered by the user. If the value entered is less than one, the program prints nothing. If the user enters a positive integer, n, the program prints an n×n box drawn with * characters. If the users enters 1, for example, the program prints * If the user enters a 2, it prints ** ** An entry of three yields.	**2**
8	Write a Python program to sum of two given integers. However, if the sum is between 15 to 20 it will return 20. Write a Python program to compute the future value of a specified principal amount, rate of interest, and a number of years. Test Data : amt = 10000, int = 3.5, years = 7 Expected Output : 12722.79	**2**
9	Write a Python program to create an array of 5 integers and display the array items. Access individual element through indexes. Write a Python program to convert an array to an ordinary list with the same items.	**2**
10	Write a Python program to display all the member name of an enum class ordered by their values. Expected Output: Country Name ordered by Country Code: Afghanistan Algeria Angola Albania Andorra Antarctica	**2**
11	Write a Python program to get all values from an enum class. Expected output: [93, 355, 213, 376, 244, 672].	**2**
12	Write a Python program to get an array buffer information Expected Output: Array buffer start address in memory and number of elements. (25855056, 2)	**2**
13,14	Write a Python program to push three items into a heap and return the smallest item from the heap. Also Pop and return the smallest item from the heap ExpectedOutput: Items in the heap: ('V', 1) ('V', 3) ('V', 2) ---------- The smallest item in the heap: ('V', 1) ---------- Pop the smallest item in the heap: ('V', 2) ('V', 3)	**4**
15,16	Write a function named print_big_enough that accepts two parameters, a list of numbers and a number. The function should print, in order, all the elements in the list that are at least as large as the second parameter.	**4**
17,18	Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas. 2. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color. 3. Write a function called draw_point that	**4**

	takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas. 4. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas. 5. Write a program that draws the national flag of the India. Hint: you can draw a polygon like this: points = [[-150,-100], [150, 100], [150, -100]] canvas.polygon(points, fill='saffron,white,green')	
19,20	The datetime module provides date and time objects that are similar to the Date and Time objects in this chapter, but they provide a rich set of methods and operators. Read the documentation at http: // docs. python. org/ 2/ library/ datetime. html . 1. Use the datetime module to write a	**4**
	program that gets the current date and prints the day of the week. 2. Write a program that takes a birthday as input and prints the user‟s age and the number of days, hours, minutes and seconds until their next birthday. 3. For two people born on different days, there is a day when one is twice as old as the other. That‟s their Double Day. Write a program that takes two birthdays and computes their Double Day. 4. For a little more challenge, write the more general version that computes the day when one person is n times older than the other.	
21,22	This exercise is a cautionary tale about one of the most common, and difficult to find, errors in Python. Write a definition for a class named Kangaroo with the following methods: 1. An_init_ method that initializes an attribute named pouch_contents to an empty list. 2. A method named put_in_pouch that takes an object of any type and adds it to pouch_contents. 3. A_str method that returns a string representation of the Kangaroo object and the contents of the pouch. Test your code by creating two Kangaroo objects, assigning them to variables named kanga and roo, and then adding roo to the contents of kanga‟s pouch.	**4**
23,24	You will write code that makes Turtles play tag. If you are not familiar with the rules of tag, see http: // en. wikipedia. org/ wiki/ Tag_ (game) . 1. Download http: // thinkpython. com/ code/ Wobbler. py and run it. You should see a TurtleWorld with three Turtles. If you press the Run button, the Turtles wander at random. 2. Read the code and make sure you understand how it works. The Wobbler class inherits from Turtle, which means that the Turtle methods lt, rt, fd and bk work on Wobblers. The step method gets invoked by TurtleWorld. It invokes steer, which turns the Turtle in the desired direction, wobble, which makes a random turn in proportion to the Turtle‟s clumsiness, and move, which moves forward a few pixels, depending on the Turtle‟s speed. 3. Create a file named Tagger.py. Import everything from Wobbler, then define a class named Tagger that inherits from Wobbler. Call make_world passing the Tagger class object as an argument. 4. Add a steer method to Tagger to override the one in Wobbler. As a starting place, write a version that always points the Turtle toward the origin. Hint: use the math function atan2 and the Turtle attributes x, y and heading. 5. Modify steer so that the Turtles stay in bounds. For debugging, you might want to use the Step button, which invokes step once on each Turtle. 6. Modify steer so that each Turtle points toward its nearest neighbor. [Hint: Turtles have an attribute, world, that is a reference to the TurtleWorld they live in, and the TurtleWorld has an attribute, animals, that is a list of all Turtles in the world. 7. Modify steer so the Turtles play tag. You can add methods to Tagger and you can override steer and_ init_ , but you may not modify or override step, wobble or move. Also, steer is allowed to change the heading of the Turtle but not the position. Adjust the rules and your steer method for good quality play; for example, it should be possible for the slow Turtle to tag the faster Turtles eventually.]	**4**
25,26	A vector graphics editor is a program that allows users to draw and edit shapes on the screen and generate output files in vector graphics formats like Postscript and SVG. Write a simple vector graphics editor using Tkinter. At a minimum, it should allow	**4**

	users to draw lines, circles and rectangles, and it should use Canvas.dump to generate a Postscript description of the contents of the Canvas. As a challenge, you could allow users to select and resize items on the Canvas	
27,28	Use Tkinter to write a basic web browser. It should have a Text widget where the user can enter a URL and a Canvas to display the contents of the page. You can use the urllib module to download files (see Exercise 14.6) and the HTMLParser module to parse the HTML tags (see http: // docs. python. org/ 2/ library/ htmlparser. html). At a minimum your browser should handle plain text and hyperlinks. As a challenge you could handle background colors, text formatting tags and images.	**4**
Total Lab hours		**56**

Minor Project(s) – (Only for 2 credit lab)

1. Create a Python project of a Magic 8 Ball which is a toy used for fortune-telling or seeking advice.
    a. Allow the user to input their question.
    b. Show an in progress message.
    c. Create 10/20 responses, and show a random response.
    d. Allow the user to ask another question/advice or quit the game.
2. The “rank” of a word is its position in a list of words sorted by frequency: the most common word has rank 1, the second most common has rank 2, etc. Zipf‟s law describes a relationship between the ranks and frequencies of words in natural languages (http: // en. wikipedia. org/ wiki/ Zipf's_ law). Specifically, it predicts that the frequency, f , of the word with rank r is: f = cr−s where s and c are parameters that depend on the language and the text. If you take the logarithm of both sides of this equation, you get: log f = log c
− slog r. So if you plot log f versus log r, you should get a straight line with slope −s and intercept log c. Write a program that reads a text from a file, counts word frequencies, and prints one line for each word, in descending order of frequency, with log f and log r. Use the graphing program of your choice to plot the results and check whether they form a straight line. Can you estimate the value of s?

Suggested Books/Resources:

1. Learning with Python: How to Think Like a Computer Scientist Paperback – Allen Downey , Jeffrey Elkner, 2015
2. Exploring Python, Timothy A. Budd, Mc Graw Hill Education
3. Introduction to Python for Computational Science and Engineering (A beginner's guide), Hans Fangohr
4. Learning Python, Fourth Edition, Mark Lutz, O‟Reilly publication
5. How to Make Mistakes in Python Author: Mike Pirnat
6. Head First Python Paperback – by Paul Barry
7. Link to topics related to course:
    a. Think Python How to Think Like a Computer Scientist
    b. https://greenteapress.com/wp/think-python/
    c. https://www.w3schools.com/python/
    d. https://www.python.org/

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	2	3	1	2	3	3	2	1	1	1	3	**2.1**
CO2	3	3	3	1	2	3	3	3	2	1	1	3	**2.3**
CO3	3	3	3	1	2	3	2	3	2	1	1	3	**2.3**
CO4	3	3	3	3	3	3	3	2	2	1	1	3	**2.5**
CO5	3	3	3	2	2	3	3	3	2	1	1	3	**2.4**
C06	3	3	3	2	3	2	3	2	2	1	1	3	**2.3**
Average	**3**	**2.8**	**3**	**1.7**	**2.3**	**2.8**	**2.8**	**2.5**	**1.8**	**1**	**1**	**3**	

Introduction to Numerical Computing Lab

COURSE CODE: 24BS7MA371

COURSE CREDIT: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basic knowledge of Python programming.

Course Objectives: This course introduces student's theoretical and practical aspects of a relatively wide spectrum of numerical techniques and familiarize the student with numerical coding using Python language. On completion of the course, students will be able

1. To exercise the fundamentals of numerical analysis in the Python environment.
2. To develop programs for various numerical methods in Python programming.

S. No.	Course Outcomes	Level of Attainment
CO-1	Getting familiar with Python, learn data input, vector functions and arrays, understand to write Python functions and implementation.	Familiarity
CO-2	Learn to write and execute programs for solving algebraic & transcendental equation, and system of linear equations & eigen value problems.	Assessment& Usage
CO-3	Learn to write and execute programs for polynomial interpolation.	Assessment& Usage
CO-4	Learn to write and execute programs to perform numerical differentiation and integration.	Assessment& Usage
CO-5	Learn to write and execute programs for finding numerical solution of ordinary differential equations.	Assessment& Usage

List of Experiments:

S.No.	Description	Hours
1	Getting started with Python, perform basic calculations, variables and basic data structures.	2
2	Python functions, loop and recursion syntax, reading and writing data inputs, visualization and plotting.	2
3	Error types: absolute, relative and percentage error, avoiding errors.	2
4	To write a program and execute it to find roots of algebraic and transcendental equation using bisection method.	2
5	To write a program and execute it to find roots of algebraic and transcendental equation using Newton-Raphson method.	2
6	To write a program and execute it for solving systems of	2

	equations using LU- decomposition method.	
7	To write a program and execute it for calculating the eigenvalues and eigenvectors.	2
8	To write a program and execute it for interpolation using Newton-Gregory' s formula.	2
9	To write a program and execute it for polynomial interpolation using Lagrange's formula.	2
10	To write a program and execute it for numerical differentiation with noise.	2
11	To write a program and execute it for numerical integration using Trapezoidal rule.	2
12	To write a program and execute it for numerical integration using Simpson's rule.	2
13	To write a program and execute it for finding numerical solutions of ordinary differential equations (IVP) using Euler's method.	2
14	To write a program and execute it for finding numerical solutions of ordinary differential equations using Runge-Kutta's (RK) method.	2
Total Lab Hours		**28**

Suggested Text Book(s):

1. Qingkai Kong, Timmy Siauw, and Alexandre Bayen, "Python Programming And Numerical Methods: Guide For Engineers And Scientists", Academic Press Inc., 1st Edition, 2020.

Suggested Reference Book(s):

1. Robert Johansson, Numerical Python : Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib, APRESS, 2nd Edition, 2019.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 Marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Introduction to Numerical Computing Lab)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	1	1	1	1	1	2	**1.58**
CO-2	3	2	2	2	2	2	1	1	1	1	1	2	**1.67**
CO-3	2	3	3	3	3	2	2	2	3	2	3	3	**2.58**
CO-4	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
CO-5	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
Average	**2.2**	**2.6**	**2.6**	**2.6**	**2.5**	**2.4**	**2**	**1.6**	**2.2**	**2**	**2.2**	**2.6**	**2.29**

Optimization for Data Science

COURSE CODE: 24BS1MA411

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Prerequisite: Basic concepts of Linear Algebra, Calculus, and Probability.

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

- Understand optimization techniques suitable for problems that frequently appear in the areas of data science.
- Recognize and formulate convex, nonconvex, and structured optimization problems.
- Understand the basic theory and algorithms for solving large-scale problems.
- Application of Continuous optimization in learning model parameters and application of discrete optimization in inference and auxiliary tasks such as feature selection, data subset selection, model compression, etc.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand foundational material in multivariate calculus required for data science and learn how the least squares method is used to apply linear regression.	Familiarity & Assessment
CO-2	Understand and solve linear and nonlinear optimization problems and dual formation of the problem.	Familiarity
CO-3	Analyze and implement optimization algorithms to solve various types of problems in data science.	Familiarity & Usage
CO-4	Learn to construct ADAM datasets and algorithms, feature selection, and classification models like logistics.	Familiarity & Usage
CO-5	Understand binary classification models, support vector machines, nonlinear support vector machines, and kernel functions.	Familiarity & Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Data Optimization, Fundamental Concepts of Multivariate Calculus, Derivative, Gradient, Directional Derivatives, Jacobian and Hessian Matrices, Taylor Approximation, Linear Regression: Least Squares and Robust.	**10**
2	Linear Programming: Graphical Method, Simplex Method, Mixed-integer Linear Programming, Duality in Linear Programming, Convexity and Convex Functions, Introduction to Nonlinear Programming: KKT conditions.	**10**
3	Fundamentals of Continuous Optimization, Line Search, Gradient Descent, Acceleration Methods, Levenberg-Marquardt Algorithm, Projection Gradient Descent. Sub Gradients, Sub Gradient Method, Stochastic Gradient Descent Method.	**12**
4	Adagrad, RMSProp, ADAM Optimizers, Bias Correction in ADAM, Feature Selection and Compressed Sensing, Logistic Regression, Support Vector Machines, Nonlinear Support Vector Machines, and Kernel Functions.	**10**
	Total Lectures	**42**

Suggested Text Book(s):

1. B. Recht and S. J. Wright, *Optimization for Data Analysis*, Cambridge University Press, 2022.
2. S. Chandra, Jaydeva, and A. Mehra, *Numerical Optimization with Applications*, Narosa, 2009.
3. D. G. Luenberger and Y. Ye, *Linear and nonlinear programming*, Springer, New York, 2008.
4. S. Boyd and V. Lieven, *Convex optimization*, Cambridge University Press, 2004.
5. N. Yurii, *Introductory lectures on convex optimization: a basic course*, Springer-Verlag New York Inc., 2004.

Suggested Reference Book(s):

1. A. Beck, *First-Order Methods in Optimization*, MOS-SIAM Series on Optimization, 2017.
2. S. Bubeck, *Convex Optimization: Algorithms and Complexity*, Foundations & Trends in Optimization, 2015.
3. F. Bach, *Learning with Submodular Functions: A Convex Optimization Perspective*, Foundations, and Trends in Machine Learning, Now Publishers Inc., 2013.
4. J. Nocedal and S. Wright, *Numerical optimization,* Springer Science & Business Media, 2006.

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignments (2) - 08 Quizzes (3) -12 Attendance -05

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Optimization for Data Science)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	2	2	2	2	2	2	2	2	2	2	**2.2**
CO-2	3	2	3	3	3	3	3	3	3	3	2	3	**2.8**
CO-3	3	2	3	3	2	3	2	3	3	3	2	3	**2.7**
CO-4	3	2	2	3	3	2	3	2	3	3	2	3	**2.6**
CO-5	3	3	3	3	3	3	3	3	3	3	2	3	**2.9**
Average	**3**	**2.4**	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2**	**2.8**	

Multivariable Calculus in Machine Learning

COURSE CODE: 24BS1MA412

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Prerequisite: Basic knowledge of Calculus and Probability distributions.

Course Objectives: This course is designed to foster a comprehensive understanding of multivariable calculus, with particular attention to its applications in machine learning and data science with the following objectives:

- Understand key concepts of multivariable calculus, including partial derivatives and gradients.
- Learn and apply multiple integrals for calculating areas, volumes, and transformations of variables.
- Explore and apply vector calculus concepts like divergence, curl, Green's Theorem in practical contexts.
- Learn principles of optimization techniques with applicability in data science and machine learning models

Course Outcomes: On successful completion of this course, a student will be able to

S. No.	Course Outcomes	Level of Attainment
CO-1	Compute partial derivatives, apply the chain rule, and analyze the behavior of multivariable functions, including applications in machine learning algorithms such as backpropagation.	Familiarity & Assessment
CO-2	Evaluate double and triple integrals, apply Fubini's Theorem, and use the Jacobian matrix for variable transformations, with practical applications in Bayesian models and other probabilistic frameworks.	Familiarity & Usage
CO-3	Develop the skills to calculate divergence, curl, and line integrals, apply Green's Theorem, and understand the role of convolutions in neural networks, particularly CNNs.	Familiarity & Usage
CO-4	Understand optimization methods, including gradient descent and Lagrange multipliers, and will be able to address optimization challenges in machine learning, such as local minima and saddle points, for models like SVMs and regression models.	Familiarity & Usage

Course Contents:

Unit	Contents	Lectures required
1	**Functions of Several Variables:** Introduction to multivariable functions - level curves, level surfaces; differentiability, partial derivatives, chain rule for multivariable functions: differentiating composite functions of several variables (tree diagram); directional derivatives, gradient vectors - to find the direction of steepest descent; implication of chain rule in backpropagation.	**10**
2	**Multivariable Integration:** Double and triple integrals, iterated integrals; Fubini's Theorem for switching the order of integration in multidimensional integrals; change of variables: Jacobian matrix for transformations of variables in integrals; applications of expectation, variance, and integrals in Bayesian models.	**8**
3	**Vector Calculus:** Vector fields; behavior of vector fields: divergence and curl; line integrals in calculating work done and energy flow across vector	**10**

	fields; Green's Theorem; convolutions as integrals and their application in Convolutional Neural Networks.	
4	**Applied Calculus in Data Science**: Second-order conditions: convexity, and curvature, Hessian matrix; constrained optimization: Lagrange multipliers method; gradient descent and its use in minimizing ML cost functions; Optimization challenges in ML: local minima, saddle points; use of Lagrange multipliers in Support Vector Machines; Mean squared error (MSE) as cost functions in regression models.	**14**
Total Lectures		**42**

Textbooks:

1. James Stewart, "*Multivariable Calculus*," 9th Edition, Cengage Learning, 2020.
2. George B. Thomas, Maurice D. Weir, "*Thomas' Calculus"*, 14th Edition, Pearson, 2018.
3. Hajime Sorimachi, Mathematical Foundations of Data Science Using Calculus and Linear Algebra, 1st Edition, Springer, 2022.

Reference Books:

1. Tom M. Apostol, "*Calculus, Vol. II: Multi-Variable Calculus and Linear Algebra with Applications to Differential Equations and Probability*," 2nd Edition, Wiley, 1969.
2. Jerrold E. Marsden, Anthony Tromba, "*Vector Calculus*," 6th Edition, W.H. Freeman and Company, 2011.
3. Jeremy E. Taylor and Rachel B. Schirrmacher, "*Essential Calculus for Data Science*," 1st Edition, Manning Publications, 2021.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1.0 Hour	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2.0 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignments (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (MC in ML)	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	**Average**
CO-1	3	3	2	3	2	1	1	1	1	1	2	2	**1.83**
CO-2	3	3	3	2	3	1	2	1	1	1	2	2	**2.00**
CO-3	3	2	3	3	3	1	1	1	1	1	2	2	**1.92**
CO-4	3	3	3	3	3	1	2	1	1	1	2	2	**2.08**
Average	**3.0**	**2.8**	**2.8**	**2.8**	**2.8**	**1.0**	**1.5**	**1.0**	**1.0**	**1.0**	**2.0**	**2.0**	**1.96** **1.98**

Finance and Accounts

COURSE CODE: 18B11HS411
COURSE CREDITS: 3
CORE/ELECTIVE: CORE
L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. Understand the issues and framework of accounting and corporate finance.
2. Prepare financial statements.
3. Analyze financial statements using different techniques.
4. Analyze projects, its financial needs, financial performance and design a suitable strategy in case of conflicting recommendations.
5. Make optimal financial decisions on sustainable basis, not only for the firm but also for the society at large.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic concepts of accounting and finance and their interrelationships	Familiarity
CO-2	Prepare different types of financial statements from Journal to Balance Sheet.	Assessment
CO-3	Analyze financial statements using different tools and techniques and hence be able to calculate the value of the firm.	Assessment
CO-4	Calculate financing needs of the firm, effects of time on value of money, availability of finances and their costs, requirement of mix of finances, evaluation of projects	Usage
CO-5	Apply the concepts and make optimal decisions	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Accounting:** Basic concepts of accounting, Accounting standards and Policies, Accounting Concepts and Conventions. Accounting Equation, Preparation of Journal, Ledger and Trial Balance	6
2	**Preparations of Final Accounts:** Understanding adjustments, Preparation of Final Accounts – Trading, Profit and Loss, Balance Sheet, Use of MS-Excel for financial statement analysis	6
3	**An Overview of Financial Management:** Nature and scope of financial management, Role of finance function, Finance decisions of the firm, Objective function in finance, Agency costs and corporate governance, Financial management and accounting, Financial objectives and organizational strategy	2
4	**Comparative and Historical Analysis:** Analyzing financial statement – Ratio Analysis – liquidity ratios, capital structure ratios, working capital ratios, profitability ratios, valuation ratios, Interlinking the ratios- Dupont analysis, Uses and limitations of ratio analysis	5
5	**Sources of Finance:** Role of financial markets, Financial Markets- segments, products and services, Long-term sources of finance - Equity, Debt, Debentures/Bonds	2
6	**Time Value of Money:** Basics of time value, Finding future value, Discounting and present value, Future value of annuity,, Present value of annuity, Periodicity of compounding and discounting, Equated monthly installments	3
7	**Cost of Capital:** Opportunity cost of capital, Weighted average cost of capital (WACC), Cost of Debt, Cost of preference capital, Cost of equity, Assigning weights, WACC, Factors affecting cost of capital	3
8	**Capital Structure – Theory:** Common assumptions for analysis, Net income approach, Net operating income approach, Traditional approach, MM theory	2

	without and with corporate taxes, Leverage and financial distress, Trade-off theory, Pecking order theory.	
9	**Designing Capital Structure:** Operating leverage, Financial leverage, EBIT-EPS analysis, ROI-ROE analysis, Defining target/ optimal capital structure	**3**
10	**Capital Budgeting:** Features of capital budgeting decisions, Types of projects. Techniques of evaluation of capital budgeting decisions, Accounting rate of return, Payback period method, Net present value method, Internal rate of return. NPV and IRR – A comparison, Conflict between IRR and NPV, Advantages of NPV and IRR, Modified IRR, Projecting cash flows, Principles of cash flow projections, Cautions in capital budgeting and cash flow projection.	**6**
11	**Working Capital Management:** Meaning of working capital, Scope of working capital management, Working capital needs of different types of businesses. Operating cycle and its relevance for WCM, Working capital financing policies. Working capital policy, Estimation of working capital requirements.	**4**
Total Lectures		**42**

Suggested Text Book(s):

1. P. C. Tulsian: Financial Accounting, Pearson Education
2. Rajiv Srivastava and Anil Misra: Financial Management, 2nd Edition, Oxford University Press
3. I. M. Pandey: Financial Management, 9th Edition, Vikas Publishing House

Suggested Reference Book(s):

1. V. Rajasekaran and R. Lalitha, Financial Accounting, Pearson Accounting
2. E. F. Brigham: Fundamentals of Financial Management, Thomson Learning
3. Sheeba Kapil: Financial Management, Pearson Education

Other useful resource(s):

1. Link to NPTEL course contents:
   https://nptel.ac.in/courses/110101003/
   https://nptel.ac.in/courses/110107073/
   https://nptel.ac.in/courses/110104066/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Finance and Accounting)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	0	1	1	1	1	1	1	0	1	0	1	1	0.75
CO-2	0	2	2	2	2	1	0	1	2	0	3	2	1.42

Approved in Academic Council held on 28 June 2023

CO-3	0	3	2	3	2	0	1	0	2	0	3	1	1.42
CO-4	0	3	3	3	3	1	1	0	2	1	3	1	1.75
CO-5	0	3	3	3	3	1	1	0	2	0	3	2	1.75
Average	0	2.4	2.2	2.4	2.2	0.8	0.8	0.2	1.8	0.2	2.6	1.4	1.4

Design and Analysis of Algorithms

COURSE CODE: 18B11CI412

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: Data structure and algorithms

Course Objectives:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.	Technical
CO-2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.	Technical
CO-3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.	Technical
CO-4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.	Technical
CO-5	For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.	Technical
CO-6	Explain the ways to analyze randomized algorithms (expected running time, probability of error).	Technical
CO-7	Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).	Technical

Course Contents:

Unit	Contents	Lectures required
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters‟ theorem. Examples: Binary counter, Recursive Fibonacci in LogN	**10**
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies for the design of Algorithms; Illustrations of these techniques for Problem- Solving , Bin Packing, Knap Sack TSP. Heuristics characteristics and their application domains. Examples: Greedy and dynamic scheduling, Hoffman encoding, Dynamic programming: Longest common subsequence, Matrix chain multiplication, Dynamic programming: Bin packing, Knapsack, Dynamic programming: TSP,	**8**

	Branch and Bound TSP, Backtracking: SAT, Maze Sudoku solver, 8 queen	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm. Examples: Best first search, Binomial heap MST: Prims, Kruskal, Fibonacci heap MST: Tarjan, Lazy decrease key implementation and Dijkstra, MaxFlow/ MinCut Ford-Fulkersion	**8**
4	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook‟s theorem, Standard NP-complete problems and Reduction techniques. Examples: Set Cover, Vertex cover, Map coloring, chromatic number	**8**
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems, beyond NP – P SPACE, Examples: Approximate matrix inversion, Randomized Eigen vector computation	**8**
Total lectures		**42**

Suggested Text Book(s):

1. Rntroduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Suggested Reference Book(s):

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,
3. Michael T Goodrich and Roberto Tamassia, Wiley.
4. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc18_cs20/preview
2. Link to topics related to course:
   i. https://nptel.ac.in/courses/106101060/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Design and Analysis of Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	3	1	1	3	3	3	1	3	**2.5**
CO-2	2	2	2	2	2	1	1	1	2		1	2	**1.6**

Approved in Academic Council held on 28 June 2023

CO-3	3	3	3	3	3	1	1	1	3	1	1	3	**2.2**
CO-4	2	2	2	2	2	2	1	1	2		2	2	**1.8**
CO-5	2	2	2	2	2	3	1	1	2	2	2	2	**1.9**
CO-6	2	2	2	2	2	2	1	2	2	2	2	2	**1.9**
CO-7	2	2	2	2	2	2	1	2	2	2	2	2	**1.9**
Average	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**1.7**	**1**	**1.6**	**2.3**	**2**	**1.6**	**2.3**	

Modeling and Simulation Techniques

COURSE CODE: 18B11CI413

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

L-T-P: 2-0-0

Pre-requisite: Discrete Mathematics, Algorithm, Software Engineering

Course Objectives:

1. Student will model real-world systems and implement the model as a computer program
2. Student will learn model design and development comparison to analytical models.
3. Student will learn important methods of computing and statistics.
4. Student will learn important techniques of real world project development and management.
5. Student will learn to evaluate the performance of real-world systems by analyzing the output of the model under various conditions..

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the basic concepts, applications and terminology of computer simulation and modeling.	Familiarity
CO-2	To learn statistical methods of estimation and testing and other relevant concepts	Technical
CO-3	To explain the working and applications of different types of simulation such as Monte Carlo, VS. Discrete Event	Technical
CO-1	You will learn how to model a system and the execution of simulation tools.	Technical
CO-2	You will learn to analyze input data, its parameters, and the use of random number in a typical simulation study.	Technical
CO-3	Student will learn different techniques for the Verification and Validation of a simulation study	Technical

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Simulation and Modeling:** Simulation: Definition, Methods, Systems, Variability, Complexity, Advantages. Modelling: Definition, characteristics, description, categories.	5
2	**Statistical Concepts:** Hypothesis, Estimation, Statistical Significance, Error/Risks. Statistical tests, Bounds and Correlation. Input Data Modelling, Output Data Analysis.	5
3	**Discrete-Event Simulation, Monte Carlo Simulation:** Queuing System Model Components, Simulation Methodology, DES Example, Implementation, Arena Simulation. The Monte Carlo Method, Sensitivity Analysis	8
4	**Systems Modeling:** System Model Types, Modeling Methodologies and Tools, Analysis of Modeling and Simulation, Operation Research Methods, Coding the Model, Use of Pseudo Random Number Streams.	8
5	**Data Collection and Analysis :** Obtaining Data, Data Format, Representing Unpredictable Variability, Distributions, Bootstrapping, Fitting Statistical Distributions to Empirical Data	8
6	**Verification, Validation, and Accreditation:** Definition and concepts, Difficulties, Confidence as Validity. Conceptual Model Validation, Data Validation, White-Box Validation, Black-Box Validation, Experimentation Validation, Solution Validation, Independent Verification and Validation	8

Total lectures	42

Suggested Text Book(s):

1. Modeling and Simulation: Exploring Dynamic System Behavior, Authors: Birta, Louis G., Arbez, Gilbert
2. Simulation (5th Edition) , Authors: Sheldon Ross.

Suggested Reference Book(s):

1. MODELING AND SIMULATION FUNDAMENTALS Theoretical Underpinnings and Practical Domains by John A. Sokolowski Catherine M. Banks.
2. Science in the Age of Computer Simulation by ERIC WINSBERG
3. Modeling and Simulation: The Computer Science of Illusion. By Raczynski, S..

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/106104019/
2. Link to topics related to course:
   i. https://nptel.ac.in/courses/106104019/1
   ii. https://nptel.ac.in/courses/106104019/4
   iii. https://nptel.ac.in/courses/106104019/26
   iv. https://nptel.ac.in/courses/106104019/2Ev

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Data Simulation and Modeling Techniques)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	1	2	1	3	3	2	3	3	3	**2.5**
CO-2	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**
CO-3	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**
CO-4	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**
CO-5	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**

CO-6	3	3	3	1	2	3	3	3	3	3	3	3	**2.8**
Average	**3**	**3**	**3**	**2.3**	**2**	**2**	**3**	**3**	**2.2**	**3**	**3**	**3**	

Optimization for Data Science Lab

COURSE CODE: 24BS7MA471

COURSE CREDIT: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basic knowledge of Python programming.

Course Objectives: This course introduces students to the theoretical and practical aspects of a relatively wide spectrum of optimization techniques for data science and familiarizes them with Python programming. Upon completion of the course, students will be able to:

3. Implement fundamental optimization techniques in the Python environment.
4. Develop programs for various optimization algorithms useful for Data Science in Python programming.

S. No.	Course Outcomes	Level of Attainment
CO-1	Getting familiar with Python, learning data input, vector functions, and arrays, installation of packages and libraries, understanding to write Python functions, and implementation.	Familiarity
CO-2	Learn to write and execute programs for solving linear and nonlinear programming problems.	Assessment & Usage
CO-3	Learn to write and execute programs for line search, acceleration, and projection optimization methods.	Assessment & Usage
CO-4	Learn to write and execute programs for sub-gradient, stochastic, and logistic regression.	Assessment & Usage
CO-5	Learn to write and execute programs for support vector machines, nonlinear SVM, and kernel methods.	Assessment & Usage

List of Experiments:

S. No.	Description	Hours
1	Getting started with Python, different packages for optimization, and writing a program for regression models.	2
2	To write a program and execute it for linear programming.	2
3	To write a program and execute it for nonlinear programming.	2
4	To write a program and execute it for the Gradient Descent algorithm.	2
5	To write a program and execute it for the Levenberg-Marquardt algorithm.	2
6	To write a program and execute it for acceleration methods.	2
7	To write a program and execute it for Projection Gradient Descent.	2
8	To write a program and execute it for the Sub-gradient method.	2
9	To write a program and execute it for the Stochastic Gradient Descent method.	2
10	To write a program and execute it for Adagrad,RMSProp,& ADAM.	2

11	To write a program and execute it for logistic regression.	2
12	To write a program and execute it for support vector machine.	2
13	To write a program and execute it for nonlinear support vector machines.	2
14	To write a program and execute it for nonlinear support vector machines using different kernel functions.	2
Total Lab Hours		**28**

Suggested Text Book(s):

1. A. Subasi, *Practical machine learning for data analysis using python*, Academic Press, 2020.
2. Q. Kong, T. Siauw, and A. Bayen. *Python programming and numerical methods: A guide for engineers and scientists*. Academic Press, 2020.
3. S. Shalev-Shwartz and S. Ben-David, *Understanding Machine Learning from Theory to Algorithms*, Cambridge University Press, 2014.

Suggested Reference Book(s):

1. M. L. Bynum et al., *Pyomo-Optimization Modeling in Python*, Springer Optimization and Its Applications Book, 3rd Edition, Kindle Edition, 2021.
2. U. José, *Python programming for data analysis*. Springer Nature, 2021.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 Marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Introduction to Numerical Computing Lab)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	1	1	1	1	1	2	**1.58**
CO-2	3	2	2	2	2	2	1	1	1	1	1	2	**1.67**
CO-3	2	3	3	3	3	2	2	2	3	2	3	3	**2.58**
CO-4	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
CO-5	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
Average	**2.2**	**2.6**	**2.6**	**2.6**	**2.5**	**2.4**	**2**	**1.6**	**2.2**	**2**	**2.2**	**2.6**	

Multivariable Calculus in Machine Learning Lab

COURSE CODE: 24BS7MA472

COURSE CREDIT: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Prerequisite: Basic knowledge of Python programming

Course Objectives: This course focuses on applying various multivariable calculus concepts using Python, with emphasis on real-world applications in machine learning and data science. The course objectives include:

- Develop proficiency in Python programming to solve multivariable calculus problems.
- Apply numerical & symbolic methods for derivatives, integrals, and vector calculus operations.
- Solve basic optimization problems, including constrained optimization using Lagrange multipliers.
- Analyze local minima and saddle points in machine learning, and evaluate Python-based solutions

Course Outcomes: On successful completion of this Lab course, a student will be able to

S. No.	Course Outcomes	Level of Attainment
CO-1	Ability to compute and visualize derivatives and integrals using Python for multivariable calculus problems, including partial derivatives and iterated integrals.	Familiarity
CO-2	Proficiency in using Python to solve vector calculus problems, such as computing divergence, curl, and line integrals, with applications to physics and machine learning.	Assessment & Usage
CO-3	Skill in implementing optimization techniques, including gradient descent and Lagrange multipliers, to solve machine learning problems using Python.	Assessment & Usage
CO-4	Capability to address optimization challenges like local minima and saddle points in machine learning models through Python-based simulations and visualizations.	Assessment & Usage

List of Experiments:

S. No.	Description	
1	Introduction of Python for mathematical computations; Basic operations on vectors, plotting functions of two variables, symbolic differentiation.	2
2	Compute partial derivatives, and visualize gradients in 3D using SymPy.	2
3	Write Python functions to apply the chain rule, visualizing changes in directional derivatives.	2
4	Implement gradient descent from scratch in Python, optimizing function.	2

5	Solve examples of double and triple integrals in Python, compare results with symbolic integration using SciPy.	2
6	Use SymPy to switch the order of integration and evaluate integrals, verify results with SciPy**.**	2
7	Perform change of variables in double integrals, calculate Jacobians for transformations.	2
8	Use NumPy and Matplotlib to visualize vector fields, compute divergence and curl using Python.	2
9	Write Python code to compute line integrals.	2
10	Use Python to identify local minima and saddle points.	2
11	Use Python to check convexity, analyze the role of the Hessian matrix.	2
12	Implement gradient descent for linear regression, visualize cost function minimization.	2
13	Solve optimization problems using Lagrange multipliers in Python.	2
14	Implement convolutions using NumPy.	2
Total Lab Hours		**28**

Text Books:

1. Yves Demazeau, Francesco Sandini, and Juan Carlos Augusto, "*Python Programming and Numerical Methods: A Guide for Engineers and Scientists,"* 1st Edition, Elsevier, 2020.
2. Sebastian Raschka, Vahid Mirjalili, "*Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow,"* 3rd Edition, Packt Publ. 2019.

Reference Books:

1. Mark J. Ablowitz, Athanassios S. Fokas, "*Complex Variables: Introduction and Applications,"* 3rd Edition, Cambridge University Press, 2021.
2. Santanu Pattanayak, "*Pro Deep Learning with TensorFlow: A Mathematical Approach to Advanced Machine Learning and Deep Learning,"* 1st Edition, Apress, 2017.

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1	Mid Sem. Evaluation	20	2.0 Hours	Syllabus covered up to Mid Sem
2	End Sem. Evaluation	20	2.0 Hours	Entire Syllabus
3	Lab Attendance	15	Entire Semester	
4	Lab Assessment	45	Entire Semester	
	Total	100		

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (MC in ML Lab)	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	**Avg.**
CO-1	3	2	2	3	3	1	1	1	1	1	2	2	**1.9**
CO-2	3	3	3	2	3	1	2	1	2	1	2	2	**2.1**
CO-3	3	3	3	2	3	1	2	1	1	1	2	2	**2.0**
CO-4	3	3	3	3	3	1	2	1	2	1	2	2	**2.3**
Average	**3.0**	**2.8**	**2.8**	**2.5**	**3.0**	**1.0**	**1.8**	**1.0**	**1.5**	**1.0**	**2.0**	**2.0**	**2.02** **2.08**

Design and Analysis of Algorithms Lab

COURSE CODE: 18B17CI472

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

L-T-P: 0-0-4

Pre-requisite: None

Course Objectives:

1. Student will understand the running time using time library functions. Learn to prepare table for input size vs. running time. Learn to measure best run and worst run of the experiments.
2. Students will learn to implement various types of design for an algorithms and compare the approaches.
3. Students will learn to implement network algorithms and their applications.
4. Students will learn to implement approximate algorithms for real world problems.
5. Students will learn to implement randomized solution for difficult real world problems.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Student will understand the running time using time library functions. Learn to prepare table for input size vs. running time. Learn to measure best run and worst run of the experiments.	Technical
CO2	Students will learn to implement various types of design for algorithms and compare the approaches.	Technical
CO3	Students will learn to implement network algorithms and their applications.	Technical
CO4	Student will learn to implement classical NP problems	Technical
CO5	Students will learn to implement approximate algorithms for real world problems.	Technical
CO6	Students will learn to implement randomized solution for difficult real world problems.	Technical

List of Experiments

S.No	Description	Hours
1	Getting acquainted with time.h, clocktick, cputime, I/O time	2
2	Getting acquainted with worst case time	2
3	Getting acquainted with Average case time	2
4	Getting acquainted with recursive program	2
5	Recursive Fibonacci in log n	2
6	Greedy and dynamic scheduling	2
7	Hoffman encoding	2
8	Dynamic programming: Longest common subsequence, Matrix chain multiplication	2
9	Dynamic programming: Bin packing, Knapsack	2
10	Dynamic programming: TSP	2
11	Branch and Bound TSP	2
12	Backtracking: SAT, Maze	2
13	Sudoku solver, 8 queen	2
14	MID sem TEST	2
15	Best first search	2
16	Binomial heap MST: Prims, Kruskal	2
17	Fibonacci heap MST: Tarjan	2
18	Lazy decrease key implementation and Dijkstra	2

19	MaxFlow/ MinCut Ford-Fulkersion	2
20	Set Cover, Vertex cover	2
21	Map coloring, chromatic number	2
22	Approximate matrix inversion	2
23	Randomized Eigen vector computation	2
24	Minor Project	2
25	Minor Project	2
26	Minor Project	2
27	Minor Project	2
28	Final test	2
Total Lab hours		**56**

Suggested Books/Resources:

1. Data Structures and Algorithms with Python, Lee and Hubbard.
2. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson
3. ink to topics related to course:
    - **a.** Python
    - **b.** SciPy
    - **c.** NumPy

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	3	1	1	3	3	3	1	3	**2.5**
CO2	2	2	2	2	2	1	1	1	2		1	2	**1.6**
CO3	3	3	3	3	3	1	1	1	3	1	1	3	**2.2**
CO4	2	2	2	2	2	2	1	1	2		2	2	**1.8**
CO5	2	2	2	2	2	3	1	1	2	2	2	2	**1.9**
CO6	2	2	2	2	2	2	1	2	2	2	2	2	**1.9**
Average	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**1.7**	**1**	**1.5**	**2.3**	**2**	**1.5**	**2.3**	