VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

VR20

SCHEME OF INSTRUCTIONS

B.Tech. PROGRAMME [VR20]

B.Tech. Degree Programs Applicable for the batch of students admitted from the Academic Year 2020-21

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(Autonomous, Accredited with 'A' grade by NAAC)
Affiliated to Jawaharlal Nehru Technological University Kakinada
Approved by AICTE & ISO 9001: 2015 Certified
Kanuru, Vijayawada -520 007, Andhra Pradesh
Phone: 0866 2582333
www.vrsiddhartha.ac.in

Effective from 2020-21

VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE
SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR20]

GROUP A (CSE, ECE, EIE, IT)

SEMESTER I **CONTACT HOURS: 26**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS1101	Basic Science Course	Matrices and Differential Calculus(ECE/EIE) Mathematics - I (CSE/IT)	3	0	0	**3**
2.	20BS1102A 20BS1102B	Basic Science Course	Engineering Physics (ECE/EIE) Applied Physics (CSE/IT)	3	0	0	**3**
3.	20ES1103	Engineering Science Course	Programming for Problem Solving	3	0	0	**3**
4.	20ES1104	Engineering Science Course	Basics of Electrical Engineering	3	0	0	**3**
5.	20HS1105	Humanities and Social Science	Technical English and Communication Skills	2	0	0	**2**
6.	20BS1151	Basic Science Course	Engineering Physics Laboratory	0	0	3	**1.5**
7.	20ES1152	Engineering Science Course	Programming for Problem Solving Laboratory	0	0	3	**1.5**
8.	20HS1153	Humanities and Social Science	Technical English and Communication Skills Laboratory	0	0	3	**1.5**
9.	20ES1154	Engineering Science Course	Computing and Peripherals Laboratory	0	0	2	**1**
10.	20MC1106	Technology and Society		1	0	0	-
			Total	**15**	**0**	**11**	**19.5**
11.	20MC1107	Induction Program					-

SEMESTER II **CONTACT HOURS: 27**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS2101	Basic Science Course	Laplace Transforms and Integral Calculus(ECE/EIE) Mathematics - II (CSE/IT)	3	0	0	**3**
2.	20BS2102	Basic Science Course	Engineering Chemistry	3	0	0	**3**
3.	20ES2103	Engineering Science Course	Object Oriented Programming using Python	3	0	0	**3**
4.	20ES2104A 20ES2104B 20ES2104C	Engineering Science Course	Basic Electronics Engineering (CSE/IT) Electronic Devices (ECE) Network Theory (EIE)	3	0	0	**3**
5.	20ES2105	Engineering Science Course	Engineering Graphics	1	0	4	**3**
6.	20BS2151	Basic Science Course	Engineering Chemistry Laboratory	0	0	3	**1.5**
7.	20ES2152	Engineering Science Course	Object Oriented Programming using Python Laboratory	0	0	3	**1.5**
8.	20ES2153	Engineering Science Course	Engineering Workshop	0	0	3	**1.5**
9.	20MC2106	Professional Ethics and Practice		1	0	0	-
Total				**14**	**0**	**13**	**19.5**

SEMESTER III **CONTACT HOURS: 28**

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1	20BS3101	Basic Science Course	Complex Analysis and Numerical Methods	3	0	0	3
2	20ES3102	Engineering Science	Discrete Mathematical Structures	3	0	0	3
3	20IT3303	Program Core	Data Structures	3	0	0	3
4	20IT3304	Program Core	Computer Organization	3	0	0	3
5	20IT3305	Program Core	Operating Systems	2	0	2	3
6	20IT3308	Program Core	Object Oriented Programming using C++	2	0	0	2
7	20ES3151	Engineering Science Lab	Web Programming Lab	0	0	2	1
8	20IT3352	Program Core Lab 1	Data Structures Lab	0	0	2	1
9	20IT3353	Program Core Lab 2	Object Oriented Programming using C++ Lab	0	0	2	1
10	20TP3106	Soft Skills – 1	Logic and Reasoning	0	0	2	1
11	20MC3107A	MC (AICTE suggested)	Environmental Studies(CSE/ECE/IT)	2	0	0	-
			Total	**18**	**0**	**10**	**21**

SEMESTER IV **CONTACT HOURS: 31**

S.No	Course Code	Course Category	Subject	L	T	P	Credits
1.	20BS4101	Basic Science	Statistics with R	2	0	2	3
2.	20IT4302	Program Core	Java Programming	3	0	0	3
3.	20IT4303	Program Core	Advanced Data Structures and Algorithms	2	1	0	3
4.	20IT4304	Program Core	Database Management Systems	3	0	0	3
5.	20HS4105	Humanities and Social Sciences	Universal Human Values 2: Understanding Harmony	3	0	0	3
6.	20IT4351	Program Core Lab1	Java Programming Lab	0	0	3	1.5
7.	20IT4352	Program Core Lab 2	Database Management Systems Lab	0	0	3	1.5
8.	20IT4353	Program Core Lab 3	Advanced programming-I	0	0	2	1
9.	20TP4106	**Soft Skills – 2**	**English for Professionals**	**0**	**0**	**2**	**1**
10	20IT4607	**Skill Oriented Course -1**		**1**	**0**	**2**	**2**
11	20MC4108B	MC (AICTE suggested)	Indian Constitution (CSE/ECE/EIE/IT)	**2**	**0**	**0**	**-**
Total				**16**	**1**	**14**	**22**
	Summer Internship six weeks (Mandatory) during summer vacation (EPICS)						
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

20BS3101B-COMPLEX ANALYSIS AND NUMERICAL METHODS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20BS1101: Matrices and Differential Calculus. 20BS2101: Laplace Transforms and Integral Calculus.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes		Upon successful completion of the course, the student will be able to:
	CO1	Determine analytic, non-analytic functions and evaluate complex integrals.
	CO2	Analyze Taylor, Laurent series and apply residue theorem for computing real definite integrals.
	CO3	Find solutions for algebraic, transcendental, system of equations and estimate functions using polynomial interpolation.
	CO4	Solve initial value problems numerically.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M												
CO2	H	M												
CO3	H	M			M								L	L
CO4	H	M			M								L	L

Course Content

UNIT I

Complex Analysis: Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula.

UNIT II

Taylor's series, Laurent's series, Zeros and Singularities of an analytic function, Residue theorem, Calculation of Residues, Evaluation of real definite integrals:(i) Integration around the unit circle (ii) Integration around a small semi-circle, Bilinear transformation.

UNIT III

Numerical Methods: Solution of Algebraic and Transcendental Equations with Newton - Raphson method, Solution of Simultaneous linear equations with Gauss - Seidel iterative method.

Interpolation: Introduction, Finite Differences-Forward, Backward and Central differences, Symbolic Relations, Newton's interpolation formulae-forward and backward differences, Central difference interpolation formulae-Gauss's, Stirling's, Bessel's formulae, Interpolation with unequal intervals - Lagrange's and Newton's

	divided difference formulae.
	UNIT IV Numerical Differentiation-First and second order derivatives using Newton's forward and backward difference formulae, Numerical integration with Trapezoidal rule and Simpsons 1/3 Rule, Numerical Solutions of Differential Equations-Taylor's series method, Euler's method, Modified Euler's method and Runge - Kutta method of 4th order.
Textbooks andReference books	**Text Book:** [1] B.S.Grewal, "Higher Engineering Mathematics", 44th Edition,Khanna Publishers, 2019. **Reference Book(s):** [1] ErwinKreyzig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2015. [2] R.K.Jain,S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishers, 2016. [3] N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9thEdition, Lakshmi Publications (P) Limited, 2016. [4] H. K. Das, Er. RajnishVerma, "Higher Engineering Mathematics", 3rdRevised Edition, S.Chand& Co., 2014. [5] S. S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition PHI Learning, 2012.
E-resources and other digital material	[1].Prof. PranavHaridas,Kerala School of Mathematics, ComplexAnalysis, (26,may,2021) Available:https://onlinecourses.nptel.ac.in/noc21_ma39/preview [2].Prof. Ameeya Kumar Nayak,Sanjeev Kumar, IIT Roorkee, Numerical methods, (26,may,2021) Available:https://onlinecourses.nptel.ac.in/noc21_ma45/preview [3].Jeremy Orloff, Massachusetts Institute of Technology: MIT Open Courseware,*Complex Variables with Applications,* Available:https://ocw.mit.edu. [4].Henrik Schmidt, Massachusetts Institute of Technology: MITOpenCourseware,*Introduction to Numerical Analysis for Engineering,* Available:https://ocw.mit.edu.

20ES3102- DISCRETE MATHEMATICAL STRUCTURES

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20BS1101: Matrices and Differential Calculus	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the logical inference and counting techniques
	CO2	Solve problems involving recurrence relations and classification of relations.
	CO3	Apply abstract algebra and evaluate the algebraic structures
	CO4	Classification of graphs and interpret their applications.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H			H				H					
CO2	H	H			H				H					
CO3	H	H			L				L					
CO4	H	L							L					

Course Content

UNIT I:

The Foundations: Logic and Proofs-Propositional Logic, Propositional equivalences, Predicates and Quantifiers, Rules of inference, Introductions to proofs.

Counting: Basics of counting, Pigeonhole principle, Generalized permutations and combinations **Generating Functions:** definition and examples, useful facts about power series, counting problems and generating functions.

UNIT II:

Advanced Counting Techniques: Recurrence Relations- Solving Linear recurrence relations-Solving homogeneous recurrence relations with constant coefficients-Solving Non homogeneous recurrence relations with constant coefficient.

Relations and Functions: Relations and their Properties, functions- one to one and onto functions, equivalence relation, partial order relations, POSET and Hasse diagrams.

UNIT III:

Group Theory: Groups- definition of a group, examples and elementary properties, sub groups, group homomorphism, Cosets and Lagrange's Theorem.

UNIT IV:

Graph Theory: Introduction(graphs, sub graphs, circuits) Sum of degrees theorem, Isomorphism and sub graphs, planar graphs, Euler's formula, Multi graphs and Euler's circuits, Hamiltonian graphs, Grin-berg's theorem, Graph coloring, Chromatic number

Text books and Reference books	**Text Book(s):** [1]. J.L Mott and A.Kandel, Discrete Mathematics for Computer scientists and Mathematicians, 2nd edition, PHI. [2]. N.ChandraShekharan and M.Umaparvathi , Discrete Mathematics ,PHI 2010 **Reference Books**: [1]. Kenneth H Rosen, Discrete Mathematics and Applications, 6th edition, McGrahill [2]. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, 4th edition(2003), Pearson education
E-resources and other digital material	[1]. Kamala Krithivasan, IIT Madras, Discrete Mathematical Structures [NPTEL], (26,may,2021)Available: http://nptel.ac.in/syllabus/syllabus.php?subjectId=106106094 [2]. DominikScheduer, Assistant Professor, Department of CSE, Shanghai Jiao Tong Univeristy Discrete Mathematics [COURSERA].,(26,may,2021) Available: https://www.coursera.org/learn/discrete-mathematics [3]. Dr. Kamala Krithivasan, IIT Madras, Discrete Mathematical Structures,[NPTEL],(26,may,2021)http://www.infocobuild.com/education/audio-video-courses/computerscience/DiscreteMathematicalStructures-IIT-Madras/lecture-16.html

20IT3303- DATA STRUCTURES

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103- Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand various techniques for searching, sorting and hashing
	CO2	Demonstratethe operations on linear data structures like stack, queue and linked list.
	CO3	Analyzevarious operations on nonlinear data structures – binary tree, binary search tree, AVL and B-trees.
	CO4	Apply data structures to solve real-time problems efficiently

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M												M	L
CO2	M	M	M										L	L
CO3		M	M										L	L
CO4		H	H									M	H	M

Course Content

UNIT I

Basic Concepts: Overview: System life cycle. Algorithm Specification, Data Abstraction, Performance Analysis, The Abstract Data Type.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Sorting: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Performance and Comparison among all the methods.

Stacks: Stacks, Evaluation of expressions: Infix to Postfix, Evaluating postfix expressions

UNIT II

Queues: ADT queue, Types of Queue: Simple Queue, Circular Queue using Dynamic Arrays, Applications of queues.

Linked Lists: Single linked list and Chains, Linked Stacks and Queues, Doubly Linked List

	Polynomials: Polynomial representation, adding polynomials, Circular List representation of polynomials
	UNIT III **Introduction to Binary Trees:** Basic Tree Terminologies, Properties of binary trees, binary tree representations. Binary Tree Traversals: In order, Preorder, Post order, level order traversal. **Binary Search Trees:** Definition, searching a Binary Search Trees (BST), Insertion into a binary search tree, Deletion from a binary search tree. **Efficient Binary Search Trees:** AVL trees- definition, rotations, insertion.
	UNIT IV **Efficient Multi Search Trees:** Introduction to m-way Search Trees, B Trees-insertion in to a B tree, deletion from a B tree. **Heaps:** Priority queues, Definition of max heap, insertion into a max heap, deletion from a max heap, Heap Sort. **Hashing:** General idea, Hash Functions, separate chaining, open addressing, rehashing, extendable hashing.
Text books and Reference books	**Text Book(s):** [1]. Horowitz Sahni and Anderson-Freed, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2011. [2]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C", 2nd edition, Addison Wesley Publication, 2010. **Reference Books:** [1]. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999. [2]. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd edition, McGraw Hill, 2008.
E-resources and other digital material	[1]. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/ [2]. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/

20IT3304 – COMPUTER ORGANIZATION

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand register transfer operations, Multiprocessors, CPU organizations and various Addressing Modes
	CO2	Identify the design requirements in organization of hardware that enables the CPU to fetch and execute instructions.
	CO3	Illustrate Fixed Point and Floating point Arithmetic Operations.
	CO4	Analyze different ways of communicating with I/O devices and Memoryorganizations.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium-M, H- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	M												L
CO2		L											L	M
CO3	M												L	M
CO4		L												L

Course Content

UNIT I:

Register Transfer and Micro-Operations: Register Transfer Language, Register Transfer, Bus and memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction cycle, Memory-Reference Instruction, Input-Output and Interrupt.

UNIT II:

Micro Programmed Control: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

Central Processing Unit: Introduction,General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Reduced Instruction Set Computer – CISC Characteristics, RISC Characteristics.

UNIT III:

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic operations

Memory Organization: Memory Hierarchy, Associative Memory, Cache Memory

	UNIT IV: **Input-Output Organization**: Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA). **Multiprocessors**: Characteristics of Multiprocessors, Interconnection structures.
Text books and Reference books	**Text Book(s):** [1]. M.Morris Mano, "Computer System Architecture, Revised Third Edition, Pearson publications, 2020. **Reference Books:** [1]. V.CarlHamachar, "Computer Organization", Fifth edition, McGraw Hill Edition, 2011 [2]. J.P.Hayes, "Computer Architecture and Organization" TMH, International Second Revised Edition, 1998 [3]. William Stallings, "Computer Organization and Architecture", Ninth Edition, Pearson/PHI, 2013 [4]. Andrew S. Tanenbaum, "Structured Computer Organization", Fifth Edition, PHI/Pearson, 2009
E-resources and other digital material	[1]. Prof.D.Roychoudhury, Department of Computer Science and Engineering,IITKharagpur **, "Lecture Series on Digital Systems", Nov 2008 https://www.youtube.com/watch?v=wXnVAcvJWDk** [2]. **Prof. S. Raman** CSE Department, **IIT Madras**. Computer Organization lecture series, NPTEL videos http://www.nptelvideos.com/course.php?id=396 [3]. Prof. Kamakoti, IIT, Chennai, May 2017 https://www.youtube.com/watch?v=MIWTxHbPBA0 [4]. Prof. Anshul Kumar, Department of Computer Science and Engineering, IIT Delhi. September 2008 http://www.infocobuild.com/education/audio-video-courses/computer-science/computer-architecture-kumar-iit-delhi.html [5]. Prof.P.K. Biswas, Department of Electronics and Electrical Communication Engineering, IITKharagpur. Introduction to Digital Computer Organization, 2009, Sep 24 https://www.youtube.com/watch?v=TH9nd-KdVHs

20IT3305 - OPERATING SYSTEMS

Course Category:	ProgrammeCore	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20ES1103 : Programming for Problem Solving	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the concepts of operating system services, Process,Multithreading, file, directory and RAID structures.
	CO2	Apply synchronization, Page Replacement, CPU scheduling algorithms
	CO3	Analyze the techniques for handling IPC, deadlocks &memory management.
	CO4	Illustrate various file allocation, free space management and disk scheduling techniques

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	L											L	
CO2	H	M												
CO3	L	H											M	
CO4	M	M											L	L

Course Content

UNIT I

Introduction: Operating System – User View, System View, Operating System Operations, Operating-System Services, System Calls.

Process Concept: Process Concept, Process Scheduling, Operations on Processes, Inter Process Communication.

Multithreaded Programming: Overview, Multicore Programming, Multi-Threading Models, Threading Issues.

UNIT II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization.

UNIT III:

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

	Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging. **Virtual Memory Management:** Background, Demand Paging, Copy-on-Write, PageReplacement-FIFO, LRU, OPTIMAL, Thrashing.
	UNIT IV: **File System:** File Concept, Access Methods, Directory and Disk Structure. **Implementing File Systems:** Allocation Methods, Free-Space Management. **Mass-Storage Structure:** Overview of Mass-Storage Structure, Disk Scheduling,RAID Structure.
Text books and Reference books	**Text Book(s):** [1]. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts", 9th ed, John Wiley &Sons (Asia) Pvt. Ltd, 2018. **Reference Books:** [1]. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd edition, McGraw-Hill Education India Pvt. Ltd, 2017. [2]. William Stallings, "Operating System: Internals and Design Principles", 8th ed, Prentice Hall ,2014. [3]. Andrew S. Tanenbaum, "Modern Operating Systems", 4th ed, PHI, 2014.
E-resources and other digital material	[1]. Prof. Chester Rebeiro Department of CSE,IITM "Introduction to Operating Systems" [NPTEL] dated 08th Sep 2016 https://nptel.ac.in/courses/106/106/106106144/ [2]. MythiliVutukuru,Dept of CSE ,IITB "Lectures on Operating Systems" dated 14th Mar 2018 https://www.cse.iitb.ac.in/~mythili/os/ [3]. Prof. P.K. Biswas,Dept of EEC,IITK "Operating Systems" dated 06th Apr 2013 http://www.satishkashyap.com/2013/02/video-lectures-on-operating-systems-by.html

20IT3308 – OBJECT ORIENTED PROGRAMMING USING C++

Course Category:	**Program Core**	**Credits:**	2
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	**20ES2103A : Object Oriented Programming using Python**	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Outline the essential features and elements of the C++ programming language
	CO2	Identify class hierarchies using the object-oriented design process
	CO3	Apply exception handling mechanism to handle errors occur at runtime
	CO4	Summarize generic classes with C++ templates.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H- High)		PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1	L												L	L
	CO2		M	H										M	L
	CO3		M											M	L
	CO4			H									M	L	L

Course Content	**UNIT I:** **Object Oriented Programming:** Introduction, Encapsulation, Polymorphism, Inheritance, Dynamic binding, Structure of C++ program. **Classes & Objects:** Classes, Structures vs Classes, Unions vs Classes, Friend Functions, Friend Classes, Inline functions, Constructors – default, parameterized, Static Class Members – Constructors and Destructors. The Scope Resolution Operator, Passing Objects to Functions, Returning Objects.this Pointer
	UNIT II: **Overloading**: Function Overloading, Overloading Constructor Functions, Copy Constructors, Operator Overloading, creating a Member Operator Function, Operator Overloading Using a Friend Function, overloading new and delete **Inheritance**: Base-Class Access Control, Inheritance and protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Virtual Base Classes.
	UNIT III: **Virtual Functions**: Calling a Virtual Function through a Base Class, Virtual attribute inheritance, Virtual functions are hierarchical, Pure Virtual Functions, early vs. Late Binding, Abstract Class **Exception Handling**: Exception Handling Fundamentals, catching class types, using multiple catch, Handling DerivedClass Exceptions, Exception Handling Options –

	Catching all exceptions, Restricting Exceptions, Rethrowing an Exception. **Templates:**Generic Functions, overloading a Generic Function, Overloading a function Template, Generic classes
	UNIT IV: **C++ Standard Template Library:** **Algorithms**: Searching, Sorting **Sequence Containers**: Vectors, Strings, Lists, Dequeues **Iterators**: as Smart Pointers, as an Interface, matching algorithms with containers
Text books and Reference books	**Text Book(s):** [1]. Herbert Schildt, "C++: The Complete Reference", Fourth Edition, The McGraw-Hill Companies, 2003. [2]. Robert Lafore, "Object-Oriented Programming in C++", Fourth Edition, Sams Publishing, USA, 2002. **Reference Books:** [1]. Ulla Kirch-Prinz&Peter Prinz, "A Complete Guide to Programming in C++", Jones and Bartlett Publishers, Canada.
E-resources and other digital material	[1]. Dr. ParthaPrathim Das, Professor, IIT Kharaghpur, " Programming in C++ ",2016, https://nptel.ac.in/courses/106/105/106105151/ [2]. Dr. AbiramRanade, Professor, IIT Bhombay, " Introduction to programming through C++", 2016, https://nptel.ac.in/courses/106/101/106101208/ [3]. Jesse Dunietz, Instructional designer, Massachusetts Institute of Technology, USA,2011, https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/index.htm [4]. A comprehensive material from pool of developers at geeks for geeks webpage, https://www.geeksforgeeks.org/c-plus-plus/ [5]. Anh Le, Programming in C++: A Hands-on Introduction Specialization, https://www.coursera.org/specializations/hands-on-cpp

20ES3151- WEB PROGRAMMING LAB

Course Category	Engineering Science	**Credits:**	1.5
Course Type	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20ES2103A: Object Oriented programming using Python	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to:

CO1	Develop static web pages using open source technologies.
CO2	Analyze different types of Cascading Style sheets
CO3	Design web applicationthat interacts with a web server
CO4	Implement Model-View-Controller pattern for web applications development
CO5	Apply custom validations to validateweb forms.
CO6	Create websites using Django framework with interactive server side scripting.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L											L	L	M
CO2					H							H	M	L
CO3					M							M	M	M
CO4	L				H							L	L	M
CO5	L				M							M	M	L
CO6	L				H							M	M	M

Course Content

Week 1: Understanding Hyper Text Markup Language

a. Differentiate HTML and HTML5
b. Design a static web page using head, body and frames.
c. Design a home page which will display your information, i.e. Bio data, using Image Link and File Link to upload images and necessary documents

Week 2: Image map and Hot spots

a. Create a HTML web page with the following:
b. To embed an image map in a web page
c. To fix the hot spots
d. Show all the related information when the hot spots are clicked

Week 3: Designing Home page

a. Create a webpage with HTML describing your department.
b. Use paragraph and list tags.
c. Apply various colors to suitably distinguish key words.
d. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.
e. Create links on the words e.g. “Wi-Fi” and “LAN” to link them to Wikipedia

	pages.
	Week 4:Use HTML form tags a. Insert an image and create a link such that clicking on image takes user to other page. b. Change the background color of the page. At the bottom create a link to take user to the top of the page c. Use HTML form tag d. Usage of textbox, paragraph, checkboxes, radio button, DropdownList and submit Button.
	Week 5: Table formatting in HTML a. Design a timetable and display it in tabular format b. Design a mark sheet and display all your marks with subjects in a tabular format c. Create a table to show your class time-table d. Design a webpage to List a table of content and navigate within the pages
	Week 6: Cascading style sheets(CSS) a. To create a web page that displays college information using various Style sheets. b. Differentiate among different types of CSS c. Design a webpage i.e. Bio data using CSS.
	Week 7:Django Introduction a. Django Basics b. Understand the MVT structure in Django
	Week 8:Django Forms a. create a form using Django. b. GET & POST in Django c. Django form fields d. Design an web page using Django validation
	Week 9: Django views Design Django CRUD (Create, Retrieve, Update, Delete) Class Based Generic Views
	Week 10: Django Models and templates a. Template filters in Django b. Template tags and variables in Django c. Explain how Django web applications access and manage data through Python objects referred to as models. d. Understand the importance of Register / Use Model e. Implement Django Model Fields and Field Options
	Week 11: Dijango forms and validation of forms a. Understand how is_valid() method is used in Instantiation of form() b. Design an web page using Django validation
	Week 12: Case study Design an interactive web pages with Dijango database connectivity
Text books and Reference	**Text Books:** [1]. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel," Internet& World Wide Web How to Program", Prentice Hall, Fifth Edition, 2011

books	[2]. Dauzon Samuel, “Django: Web Development with Python”, Packt Publishing Limited. ISBN: 9781787121386, 9781787121386 **Reference Books:** [1]. DT editorial services, “ HTML 5 Black Book “Dreamtech Press; Second edition, 2016 [2]. Mele Antonio ,”Django 3 By Example”, Packt Publishing Limited, ISBN: 9 781838981952, 9781838981952
E-resources and other digital material	[1]. Charles RusellServance, Clinical professor, University of Michigan “Django for everybody specialization”, (20, May, 2021) https://www.coursera.org/specializations/django [2]. Colleen van Lent ,Lecturer, University of Michigan “Introduction to HTML”, (20, May, 2021) ,https://www.coursera.org/learn/html

20IT3352-DATA STRUCTURES LAB

Course Category:	Program core						**Credits:**						1.5	
Course Type:	Lab						**Lecture-Tutorial-Practice:**						0-0-3	
Prerequisites:	20ES1152 Programming for Problem Solving Laboratory						**Continuous Evaluation:**						30	
							Semester end Evaluation:						70	
							Total Marks:						100	
Course Outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Illustrate various searching and sorting algorithm techniques												
	CO2	Demonstrate various operations of stack and queue data structures for problem solving												
	CO3	Usedifferent operations on lists to solve a given problem.												
	CO4	Implement operations on basic tree data structures.												
	CO5	Perform operations on balanceddata structures - AVL and B-trees												
	CO6	Solve scenario based problemsusing appropriatedata structures												
Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1	L	M	L									L	H	
	CO2	L		L											M
	CO3	M	L	L									L	M	
	CO4		M	M									M		L
	CO5		L	L										L	M
	CO6	M	M	M									M	M	M
Course Content	**Week 1: Programs on Searching & Sorting techniques** a. Implement linear and binary search techniques b. Internal sorting techniques: :Insertion Sort, Bubble sort , Radix sortand Selection sort c. External sorting techniques: Merge Sort and Quick Sort d. Design experiment using Searching and sorting techniques **Week 2&3: Stack using array and its applications** a. Implementation of possible operations on stacks using arrays b. Application-1: Convert given infix expression to postfix using stacks c. Application-2: Evaluate given postfix expression using stacks d. Application-3: Check for Balanced Brackets in given expression using Stack **Week 4: Queue using array and its applications** a. Implementation of possible operations on Queue using arrays b. Implementation of possible operations on circular queue using arrays c. Design experiment using Queue and circular Queue													

	Week 5&6: linked list and its types a. Implementation of all possible operations on single linked list. b. Implementation of all possible operations on double linked list. c. Implementation of all possible operations on circular linked list. **Week 7&8: linked list applications** a. Application-1: Implementation of possible operations on stacks using list b. Application-2: Implementation of possible operations on queue using list c. Application-3: Addition of two polynomials using linked list **Week 9: Binary search tree and applications** a. Implementation of Binary search tree operations. b. Application-1: Implement tree traversal techniques using recursion **Week 10: AVL,B- tree and applications** a. Insert and delete operations on AVL-tree b. Insert and delete operations on B-tree **Week 11: Design experiments/scenario based problem solving using linear Data structures** **Week 12: Design experiments/scenario based problem solving using nonlinear Data structures**
Text books and Reference books	**Text Book(s):** [1]. Horowitz Sahni and Anderson-Freed, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2011. [2]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C", 2nd edition, Addison Wesley Publication, 2010. **Reference Books:** [1]. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999. [2]. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning
E-resources and other digital material	[1]. Erik Demaine, Advanced Data Structures, [MIT- OpenCourseWare]. (26, May, 2021). Available: http://ocw.mit.edu/ [2]. Dr. Naveen Garg, Department of Computer Science & Engineering ,IIT Delhi, Lecture Series on Data Structures and Algorithms [NPTEL], (26,May,2021) Available: https://nptel.ac.in/courses/106/102/106102064/ [3]. Data Structures and applications on, [Geeksforgeeks], (25, May, 2021) Available: https://www.geeksforgeeks.org/data-structures/ [4]. Data Structures and challenges [Hacker rank], (25,May,2021) Available: https://www.hackerrank.com/domains/data-structures

20IT3353 OBJECT ORIENTED PROGRAMMING USING C++ LAB

Course Category:	Program Core	Credits:	2
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	20ES2152A: Object Oriented programming using Python Laboratory	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate syntax and semantics of C++ programs with specifications given in a class.
	CO2	Develop C++ programs to overload functions, constructors and operators
	CO3	Implement inheritance and its variants using C++
	CO4	Apply the concepts of virtual and pure virtual functions to solve problems.
	CO5	Apply the knowledge of exception handling to design error free applications
	CO6	Develop programs using generic classes and Standard Template Libraries for solving real time scenarios.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H-High)		PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	L		H										L	
	CO2			M									M		L
	CO3		M												M
	CO4		M											L	
	CO5				M									M	
	CO6			M									M	M	M

Course Content	**Week 1: Classes and Objects** 1. Understand and implement the concept of class and object 2. Implement data members and member functions in the class. 3. Identify the difference in implementation of single and multiple objects.
	Week 2: Constructors & Inline functions 1. Understand the concept of Constructor and its advantages, 2. Implement default and parameterized constructors 3. Understand how to implement inline functions in a class.
	Week 3: Static Data members and static members functions: 1. Understand the concept of static data member and static member function 2. Implement static member function in a class for the given application
	Week 4: Passing objects to function & friend functions 1. Implement the concept of passing object to a function. 2. Implement the concept of returning object from a function. 3. Understand the concept of friend functions.

	4. Implement the concept of friend function for the given example.
	Week 5: Constructor overloading 1. Implement method overloading for the given example. 2. Implement constructor overloading for the given example 3. Understand copy constructor and implement the copy constructor for the given example.
	Week 6: Operator Overloading 1. Implement overloading of operators. a. binary operator b. unary operator c. new and delete operators d. unary operator overloading using friend functions
	Week 7: Implement programs on Inheritance 1. Design solutions that make use of the concept of different types of inheritance 2. Implement how constructors are invoked in a. Multiple Inheritance b. Multilevel Inheritance c. Hierarchical Inheritance
	Week 8: Implement programs on virtual functions and abstract classes 1. Implement Virtual base class concept in Inheritance, 2. Understand and implement the concept of Virtual Base class. 3. Differentiate between virtual function and pure virtual function and implement them as necessary in the given application. 4. Create a solution using abstract classes by crating abstract methods.
	Week 9: Handling Exceptions **1.** Develop programs to handle run-time errors using exception handling. 2. Design applications to make use of user defined exceptions. 3. Implement programs to freeup the resource using finally
	Week 10: Generic Templates - class Templates **1.** Implement function template for the given example **2.** Create a solution for the given example using overloading a function template. 3. Understand the differences between function templates and class templates 4. Implement class templates for the given application.
	Week 11: Standard Template Library **1.**Implement operations on a. STL Vectors. b. STL List c. STL Deques d. STL Strings
	Week 12: Case study Simulate the Bank Application, Library application, Movie ticket Booking , Train ticket booking applications etc., by using C++ concepts

Text books and Reference books	**Text Book(s):** [1]. Herbert Schildt, "C++: The Complete Reference", Fourth Edition, The McGraw-Hill Companies, 2003. [2]. Robert Lafore, "Object-Oriented Programming in C++", Fourth Edition, Sams Publishing, USA, 2002. **Reference Books:** [1]. Ulla Kirch-Prinz& Peter Prinz, "A Complete Guide to Programming in C++", Jones and Bartlett Publishers, Canada.
E-resources and other digital material	[1]. Dr. ParthaPrathim Das, Professor, IIT Kharaghpur, " Programming in C++ ", 2016, https://nptel.ac.in/courses/106/105/106105151/ [2]. Dr. AbiramRanade, Professor, IIT Bhombay, " Introduction to programming through C++", 2016, https://nptel.ac.in/courses/106/101/106101208/ [3]. Jesse Dunietz, Instructional designer, Massachusetts Institute of Technology, USA,2011, https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/index.htm [4]. A comprehensive material from pool of developers at geeks for geeks webpage, https://www.geeksforgeeks.org/c-plus-plus/ [5]. Anh Le, Programming in C++: A Hands-on Introduction Specialization, https://www.coursera.org/specializations/hands-on-cpp

20TP3106 LOGIC AND REASONING

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Learning by Doing	**Lecture-Tutorial-Practice:**	1 - 0-1
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Think reason logically in any critical situation
	CO2	Analyze given information to find correct solution
	CO3	To reduce the mistakes in day to day activities in practical life
	CO4	Develop time management skills by approaching different shortcut methods
	CO5	Use mathematical based reasoning to make decisions
	CO6	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1						M								
CO2		M												
CO3								M						
CO4									M					
CO5	M													
CO6	L													

Course Content

UNIT I

1. Series Completion
2. Coding-Decoding
3. Blood Relation Blood
4. Puzzles test
5. Direction sense test

UNIT II

1. Logical Venn diagrams
2. Number test, Ranking test
3. Mathematical operations
4. Arithmetical Reasoning
5. Syllogism

	UNIT III 1. Binary Logic 2. Inserting missing character 3. Data sufficiency 4. Analogy 5. Classification
	UNIT IV **Non – Verbal:** 1. Water images 2. Mirror images 3. Paper folding 4. Paper cutting 5. Embedded Figures 6. Dot situation 7. Cubes & Dice
Text books and Reference books	**Text Book(s):** [1]. R. S. Aggarwal, " Verbal and non-verbal reasoning", Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6 **Reference Books:**
E-resources and other digital material	[1]. https://www.indiabix.com [2]. http://www.treeknox.com [3]. https://www.examveda.com

20MC3107A ENVIRONMENTALSTUDIES

Course Category:	Environmental Studies	**Credits:**	
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	Consciousness of Environment	**Continuous Evaluation:**	46+46+3+5
		Semester end Evaluation:	
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify various factors causing degradation of natural resource and Control Measures
	CO2	Identify various ecosystem and need for biodiversity
	CO3	Realize and explore the problems related to environmental pollution and its management
	CO4	Apply the information and technology to analyze social issues, use acts associated with environment

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L							L					L	
CO2		L	L							L			L	
CO3				L	L							L	L	
CO4						L	L	L					L	

Course Content

UNIT I

The Multidisciplinary Nature of Environmental Studies Definition, scope and importance Need for public awareness.

Natural Resources :

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a)Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.

(b)Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c)Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

(d)Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

	(e)Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. **(f)Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.
	UNIT II **Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and Its Conservation** Introduction, definition: genetic, species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.
	UNIT III **Environmental Pollution** Definition ,Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards **Solid waste management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. **Disaster management:** Floods, earthquake, cyclone and landslides.
	UNIT IV **Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. **Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation.Consumerism and waste products. **Environment Protection Act** Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in

	enforcement of environmental legislation. **Public awareness** Human Population and the Environment,Population growth, variation among nations, Population explosion—Family Welfare Programme. **Environment and human health** Human rights, Value education,HIV/AIDS,Women and Child Welfare, Role of Information Technology in environment and human health. **Field Work/ Case Studies** Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural.Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.
Self-Study	Water resources, Threats to biodiversity, Solid waste management, Role of Information Technology in environment and human health.
Text books and Reference books	**Text Book(s):** [1]. ErachBharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, BharatiVidyapeeth Institute of Environment Education and Research. **Reference Books:** [1]. AnjaneyuluY. Introduction to Environmental sciences, B S Publications PVT Ltd, Hyderabad [2]. Anjireddy.M Environmental science & Technology, BS Publications PVT Ltd, Hyderabad. [3]. Benny Joseph, 2005, Environmental Studies, The Tata McGraw- Hill publishing company limited, New Delhi. [4]. Principles of Environmental Science. &Engg. P.VenuGopalaRao, 2006, Prentice-Hall of India Pvt. Ltd., New Delhi. [5]. Ecological and Environmental Studies – Santosh Kumar Garg, RajeswariGarg (or) RajaniGarg, 2006, Khanna Publishers, New Delhi. [6]. Essentials of Environmental Studies, Kurian Joseph & R Nagendran, Pearson Education publishers, 2005. [7]. A.K Dee – Environmental Chemistry, New Age India Publications. [8]. BharuchaErach- Biodiversity of India, Mapin Publishing Pvt.Ltd..
E-resources and other digital material	[1]. ErachBharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, BharatiVidyapeeth Institute of Environment Education and Research. https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf [2]. NPTEL Courses - Environmental Studies By Dr. Tushar Banerjee | Devi AhilyaViswavidyalaya, Indore.

SEMESTER IV

20BS4101 – STATISTICS WITH R

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT3302 Discrete Mathematical Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the fundamental syntax of R through readings, practice exercises, demonstrations, writing R code and Visualize data attributes using ggplot2 and other R packages.
	CO2	Manipulate numeric and textual data types using the R programming language and RStudio.
	CO3	Apply the knowledge of Probability and conduct Tests of Hypothesis for Statistical Inference.
	CO4	Fit some basic types of Statistical Models.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M											M	M
CO2	M	L			M								M	M
CO3	H	M		H							M		H	M
CO4	H	M	H	M	M						H		H	M

Course Content

UNIT I:

The R Environment : Command Line interface, R Studio, Installing R Packages.

Basics of R : Basic math, variable, data types, vectors, calling function, missing data, data.frames, lists, matrices, arrays.

Reading data into R : Reading CSVs, Excel Data.

Case Study: Loading data from mysql into RStudio.

Writing R functions, control statements – if and else, switch, compound tests, for loops, while loops.

Statistical Graphs : Base Graphs, ggplot2.

UNIT II:

Group manipulation : Apply Family, aggregate, plyr, data.table.

Data Reshaping :cbind, rbind, joins, reshape2.

Strings :paste, sprint, extracting text, regular expressions.

Case Study:String Theory: To focus on manipulating unstructured data, this in most cases means natural language texts. Tweets are again a useful source of data for this because tweets are mainly a short (140 characters or less) character strings.

	Math Functions : Calculating a Probability, cumulative sums and products, minima and maxima, calculus, sorting, set operations.
	UNIT III: **Probability Distributions** : Normal Distribution, Binomial Distribution, Poisson Distribution. **Basics Statistics** : Summary statistics, correlation and covariance, t-tests, ANOVA. **Case Study:Popularity Contest:** Develop a test to compare two different Twitter topics to see which one is most popular(or at least which one has a higher posting rate)
	UNIT IV: **Linear Models** : Simple Linear Regression, Multiple Regression, Logistics Regression, Poisson Regression. **Nonlinear Models** : Nonlinear least squares, splines, generalized additive models, decision trees, random forests. **Time Series** : Autoregressive Moving Average, VAR, GARCH. **Clustering** : K Means, PAM, Hierarchical Clustering **Case Study:** 1. **Word Perfect:**Analyze the actual words that appear in text documents. 2. **Decision Tree:** Implement Decision Tree, Random Forest in R for party package.
Text books and Reference books	**Text Book(s):** [1]. Jared P. Lander, "R for Everyone, Addison Wesley Data &Analytics Series, Pearson", 2014.**(UNIT-I,II(Except Math Functions), III &IV)** [2]. Norman Matloff, "The Art of R Programming, No Strach Press", San Francisco, 2011.**(UNIT-II Math Functions)** **Reference Books:** [1]. Jeffrey Stanton, "An Introduction To Data Science", 2012 [2]. G. Jay Kerns, Introduction to Probability and Statistics using R, First Edition, 2010
E-resources and other digital material	[1]. Rafael Irizarry, Michael Love, Statistics with R, Harvard University (18, May, 2021). Available: https://www.edx.org/course/statistics-r-harvardx-ph525-1x-1 [2]. Mine Çetinkaya-Rundel, David Banks, Colin Rundel, Merlise A Clyde, Duke University, (18, May, 2021). Statistics with R Specialization. Available: https://www.coursera.org/specializations/statistics

20IT4302-JAVA PROGRAMMING

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	20ES1103Programming for Problem Solving 20IT3303 Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand object-oriented programming principles to build classes and create objects
	CO2	Analyze assertions and exception handling techniques to debug correctness and handle run time errors
	CO3	Apply the knowledge of generics, collections, legacy classes and multi-threading to solve the problems
	CO4	Demonstrate the knowledge of event handling in design of graphical user interfaces using swings

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L	M									H		M	L
CO2		M	H								M		L	M
CO3	L	H	M						H		H		H	H
CO4			M						M		M		M	H

Course Content

UNIT I:

Introduction: Overview of Java, Data Types, Variables and arrays.

Classes and objects: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, overloading methods, static and final keywords.

String Handling: The String Constructors, String Tokenizer class**.**

UNIT II:

Inheritance: Inheritance basics, using super, creating a multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance.

Packages & Interfaces: Defining a package, finding package and CLASSPATH., Packages and Member access, importing packages, Defining an interface, implementing interfaces, nested interfaces, applying interfaces, variables in interfaces.

	Exception handling: Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, throw, throws, finally, creating your own exception subclasses.
	UNIT III: **Generics:** Generic class with two type parameters, the general from of a generic class, Bounded types **Assertions:** Using assert statement, Assertion enabling and disabling options **Multithread Programming:** The Java thread model, creating a thread: implementing runnable, extending thread, creating multiple threads, thread priorities **Collections Framework:** Collections overview, Collection interfaces: Collection, List and Set. Collection Classes: ArrayList, LinkedList, HashSet,TreeSet
	UNIT – IV **Legacy classes and Interfaces:** Enumeration interface, Vector, Stack and Hashtable **The Applet Class**: Applet basics, applet architecture, applet skeleton, applet initialization and termination**.** **Event Handling:** The delegation event model- Events, Event Sources, Event Listeners. Event Classes, KeyEvent Class, Event Listener Interfaces **Swing Components:** JLabel and ImageIcon, JTextField, The Swing Buttons: JButton, CheckBox, RadioButton, JList, JComboBox
Text books and Reference books	**Text Books:** [1] Herbert Schildt, "Java The Complete Reference", 11th Edition, McGraw-Hill Education, New Delhi, 2019. **Reference Books:** [1] Kathy Sierra & Bert Bates, Head First Java, Second edition, Shroff/O'Reilly, 2009 [2] Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2013. [3] Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", 9th Edition, Prentice-Hall, Pearson Education, 2011. [4] Timothy Budd, "Understanding Object Oriented Programming with Java ", Updated edition, Pearson Education, 2013.
E-resources and other digital material	[1] Prof. I. Sengupta. (19-05-2021), Department of Computer Science & Engineering, I.I.T.,Kharagpur, "Internet Technologies", NPTEL, http://nptel.ac.in/video.php?subjectId=106105084 [2] Mia Minnes, Leo Porter, Christine Alvarado, University of California, San Diego (19-05-2021) Object Oriented Programming in Java Available: https://www.coursera.org/learn/object-oriented-java [3] Cay Horstmann, Cheng-Han Lee, Sara Tansey, San Jose State University, (19-05-2021) Intro to Java Programming Available https://eu.udacity.com/course/intro-to-java-programming--cs046

20IT4303- ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	20IT3302- Discrete Mathematics for Information Technology 20IT3303- Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to:

CO1	Understand the asymptotic performance of algorithms and various operations on data structures
CO2	Synthesize design techniques and choose appropriate technique to solve problems.
CO3	Analyze algorithm design techniques to provide optimal solution for given problem.
CO4	Distinguish deterministic and non-deterministic algorithms and their performances.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	M	L		L					L		M	L
CO2	L	M	H	M		L					M	L	L	L
CO3	M		H	M		H						L	L	H
CO4	H	M	M		M	M							H	M

Course Content

UNIT I:

Introduction: Algorithm Specification: Pseudo code Conventions, Recursive Algorithms, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big ―oh, Omega, Theta, Little ―oh).

Trees: Splay trees: A simple idea, splaying, Top-Down splay trees, Red-Black trees: Bottom-up insertion, Top-down-red-black trees, top-down deletion, Treaps, Suffix Arrays and Suffix Trees : Suffix Arrays ,Suffix Trees ,Linear-Time Construction of Suffix Arrays and Suffix Trees.

Basic Traversal and Search Techniques: Connected components and spanning trees, Biconnected components and DFS.

UNIT II:

Divide and conquer: General method, Binary search, Finding the Maximum andMinimum, Merge sort, Quick sort, Strassen‘s matrix multiplication.

	Greedy method: General method, knapsack problem, Job Sequencing with deadlines,Minimum cost spanning trees: Prim‘s and Kruskal‘s algorithms, Single source shortest path problem.
	UNIT III: **Dynamic Programming:** General method, Multistage graph problem, All pairs shortestPath problem, 0/1 knapsack problem, Travelling sales person problem. **Backtracking:** General method, 8-queens problem, sum of subsets, graph coloring,Hamiltonian cycles.
	UNIT IV: **Branch and Bound:** The method: Least Cost (LC) Search, Control Abstractions for LC-Search, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution. **NP-Hard and NP-Complete problems**: Basic concepts, non-deterministic algorithms, the classes NP Hard and NP Complete.
Text books and Reference books	**Text Book(s):** [1]. Mark Allen Weiss, “Data structure and Algorithm Analysis in C++”, 4th edition, Addison Wesley Publication, 2014. [2]. E. Horowitz, et al, ―Fundamentals of Computer Algorithms, University Press(India)Pvt. Ltd, 2 Edition 2011. **Reference Books:** [1]. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, “Introduction to Algorithms”, PHI learning Pvt.Ltd., New Delhi, 2010. [2]. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python”, 1st edition, Springer International Publishing, 2015.
E-resources and other digital material	[1] SudarshanIyengar,AssistantProfessor,CSE department, IIT Ropar, Programming, Data Structures and Algorithms [NPTEL], (26, May, 2021) Available: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/ [2] Erik Demaine, professor of Computer Science at the Massachusetts Institute of Technology , Advanced Data Structures [MIT- Open Course Ware], (26, May, 2021) Available: http://ocw.mit.edu/

20IT4304 – DATABASE MANAGEMENT SYSTEMS

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate DBMS architecture and conceptual database modeling for database design
	CO2	Formulate solutions to a broad range of query problems using SQL and relational algebra
	CO3	Develop database schemas using normalization approaches.
	CO4	Implement database techniques to model all kinds of scenarios from construction and beyond.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, H-High, M-Moderate)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L		L								L		M	L
CO2	H		M								H		M	L
CO3	H		M								H		M	M
CO4	M		H								L		M	H

Course Content

UNIT I :

Databases And Database Users: Introduction, characteristics of the database approach, actors on the scene, workers behind the scene, advantages of using the DBMS approach

Database System Concepts And Architecture: Data models, schemas, and instances, three schema architecture and data independence, Database languages and interfaces, the database system environment

Relational Data Model And Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas

UNIT II:

SQL: More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Views (Virtual Tables) in SQL

Indexing Structures for files and Physical Database Design : Types of single level ordered indexes, multilevel indexes, dynamic multi level indexes using B-trees&B+trees

The Relational Algebra: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations

	UNIT III: **Data Modeling Using The Entity-Relationship (ER) Model:** Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types **Database Design Theory And Methodology:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal forms based on Primary keys, General Definitions of First ,Second and Third Normal Forms, Boyce-Codd Normal Form, Multi valued dependency and Fourth normal form, Properties of relational decompositions
	UNIT IV: **Transaction Processing Concepts And Theory :** Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, characterizing schedules based on recoverability and Serializability **Concurrency Control Techniques:** Two phase locking techniques for concurrency control, Concurrency control based on Timestamp ordering **NoSQL :**Introduction to NoSQL systems, characteristics of NoSQL systems, categories**.** **Graph Database :** Overview, Structure and advantages of graph database, high level view of graph space, property graph model.
Text books and Reference books	**Text Book(s):** [1]. Elmasri and Navathe.Fundamentals of Database Systems. Ed 7. Pearson Education, 2016 (e Unit 1, 2,3,4 - chapter1,2, 3) [2]. Ian Robinson, Jim Webber, Emil Efriem, "Graph Databases", OReilly Media, 2015.(Unit 4-chapter 4) **Reference Books** [1].Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, TATA McGrawHill, 2008. [2].Silberschatz, Korth and Sudharshan. Data base System Concepts. Ed4. McGrawHill, 2009
E-resources and other digital material	[1]. Jennifer widom,(09,05,2018). Introduction to Databases https://www.youtube.com/watch?v=ShjrtAQmIVg [2]. P. B. Mahanty,(09,05,2015). DBMS and RDBMS. http://nptel.iitm.ac.in/video.php?courseId=1128&v=7952RsbAx2w8 [3]. Prof.D.Janakiram,(09,05,2015). DBMS. https://www.youtube.com/watch?v=EUzsy3W4I0g&list=PL536244562840E982 [4]. Karl seguin, "The Little MongoDBBooK", 2/E version 2.6, 2011.

20HS4105 UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Mandatory course (suggested by AICTE)	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	None. Universal Human Values 1 desirable.	**Continuous Evaluation:**	50
		Semester end Evaluation:	50
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand and aware of themselves and their surroundings (family, society and nature).
	CO2	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind.
	CO3	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society.
	CO4	Apply what they have learnt to their own self in different day-to-day settings in real life.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1						L			M					
CO2			H											
CO3						M								
CO4								H				M		

Course Content

UNIT I

Course introduction, need, basic guidelines, content and process for value education:

Part-1: Purpose and motivation for the course, recapitulation from UHV-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.

Part-2: 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.

(Practice sessions are to be included to discuss natural acceptance in human being as

	the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).
	UNIT II **Understanding Harmony in the Human Being – Harmony in Myself:** **Part-1**: Understanding human being as a co-existence of the sentient 'I' 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). **Part-2:** 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. (Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease).
	UNIT III **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** **Part-1:**Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment 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. **Part-2:** 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. (Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives).
	UNIT IV **Part-1:Understanding Harmony in Nature & 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.

	Part-2: 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, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) at the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) at the level of society: as mutually enriching institutions and organizations. (Part-1:Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc. Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.)
Text books and Reference books	**Text Book(s):** [1]. Human values and professional ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, New Delhi (2010). **Reference Books:** [1]. JeevanVidya: EkParichaya, A. Nagaraj, JeevanVidyaPrakashan, Amarkantak (1999). [2]. Human Values, A. N. Tripathi, New Age International Publishers, New Delhi (2004). [3]. The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York (2010). [4]. The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing (2008). [5]. Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London (1993). [6]. Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada (2006). [7]. Economy of Permanence, J. C. Kumarappa, Sarva-Seva-SanghPrakashan, Varanasi (2017). [8]. Bharat Mein Angreji Raj, PanditSunderlal, PrabhathPrakashan, Delhi (2018). [9]. Rediscovering India, Dharampal, Society for Integrated Development of Himilayas (2003). [10]. Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad (1909).

	[11]. India Wins Freedom: The Complete Version, MaulanaAbulKalam Azad, Orient Blackswan (1988). [12]. The Life of Vivekananda and the Universal gospel, Romain Rolland, AdvaithaAshrama, India (2010). [13]. Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi (2002).
E-resources and other digital material	[1]. AICTE–SIPYoutubeChannel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ [2]. AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1

20IT4351- JAVA PROGRAMMING LAB

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20ES1103Programming for Problem Solving 20IT3303 Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design solutions to applications using object oriented approach using Java
	CO2	Implement java technology to solve runtime errors and test the correctness of programs using exception handling and assertions
	CO3	Develop java applications to make use of collections framework and generics to solve real world problems
	CO4	Apply the knowledge of delegation event model to handle semantic and low level events
	CO5	Solve real world problems using Java legacy classes
	CO6	Design graphical user interface applications using Java Swings

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M										H		M	L
CO2		M	H								M		H	L
CO3		M	M						H		M	M	M	M
CO4		M	M						M		L	H	M	H
CO5		M	M						H		M	M	M	M
CO6		M	M						M		L	H	M	H

Course Content

Week 1:

Java Applications to demonstrate the knowledge in working with classes and objects

a. Creation of Classes with data members and member functions
b. Design the main method to create single and multiple objects to the classes

Week 2:

Developing java applications on the concept of Arrays, single dimension, multi-dimension arrays and constructors

a. Generate applications to make use of all types of arrays
b. Create java application to create default and parameterised constructors
c. Design a solution to make use of function overloading in polymorphism

Week 3:

Solve the problems using java with Strings:

a. Practice the various String operations on a given sentence
b. Java applications to make use of StringTokenizer class to find the individual words in a given sentence/paragraph

Week 4:

Create java applications to implement inheritance, abstract classes and interfaces

a. Design solutions that make use of the concept of different types of inheritance
b. Create a solution using java abstract classes by crating abstract methods
c. Design an interface and implement the same to a class
d. Design different interfaces and implement to a class, make it as abstract and extend to another class
e. Java application on implementing abstract classes and implement run time polymorphism

Week 5

Create classes and interfaces and make it as single unit suing java packages

a. Create classes and interfaces to generate as a package
b. Usage of user defined packages in another package / another class

Week 6 & 7

a. Java application on Exception Handling techniques and assertions
b. Java application on user defined exceptions, throw and throws keywords
c. Implementing the concept of Multithreading in Java, practical aspects of concurrency contro
d. Java application to create threads using Thread Class and Runnable interfaces

Week 8 :

Implementation of Collections and legacy classes

a. Java application to explore the Collections Framework and various collection types in Java.
b. Solve the problems using legacy classes from different coding platforms

Week 9:

Creation of java web based applications using Swings

a. Java application to develop web based programs
b. Java application to implement mouse event handling and key event handlings
c. Generate Java Web based applications to solve variety of problems

Week 10

a. GUI Development in Java by means of Swings Framework
b. Design java solutions to various e-commerce applications

Week 11 & Week 12:

Case Studies:

1. Simulate the bank, college, library applications using java technology
2. Develop GUI based application using Applets and handle events raised by the application
3. Develop Web based applications using java swings to various applications

Text books and Reference books	**Text Books:** [1] Herbert Schildt, "Java The Complete Reference", 11th Edition, McGraw-Hill Education, New Delhi, 2019. **Reference Books:** [1] Kathy Sierra & Bert Bates, Head First Java, Second edition, Shroff/O'Reilly, 2009 [2] Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2013. [3] Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", 9th Edition, Prentice-Hall, Pearson Education, 2011. [4] Timothy Budd, "Understanding Object Oriented Programming with Java ", Updated edition, Pearson Education, 2013.
E-resources and other digital material	[1] Prof. I. Sengupta. (19-05-2021), Department of Computer Science & Engineering, I.I.T.,Kharagpur, "Internet Technologies", NPTEL, http://nptel.ac.in/video.php?subjectId=106105084 [2] Mia Minnes, Leo Porter, Christine Alvarado, University of California, San Diego (19-05-2021) Object Oriented Programming in Java Available: https://www.coursera.org/learn/object-oriented-java [3] Cay Horstmann, Cheng-Han Lee, Sara Tansey, San Jose State University, (19-05-2021) Intro to Java Programming Available https://eu.udacity.com/course/intro-to-java-programming--cs046

20IT4351 DATABASE MANAGEMENT SYSTEMS LAB

Course Category:	Laboratory	**Credits:**	1.5
Course Type:	Program Core	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Experiment DDL and DML statements with integrity constraints
	CO2	Apply various SQL functions and operators in RDBMS
	CO3	Develop solutions to query problems using nested queries with various operators.
	CO4	Implement PL/SQL on stored databases.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L-Low, M-Medium, H-High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L		L								L		M	L
CO2	M		M								L		M	L
CO3	M		M								M		M	L
CO4	L		M								M		M	M

Contents

Week 1:

a. Implement the Data Definition language
b. Apply different Integrity Constraints , aliasing on relations

Week 2:

a. Construct an ER-Diagram for the given information model by using appropriate tool.
b. Convert entities and relationships to relation table for a given scenario.

Week 3:

a. Implement Data Manipulation Language on Relational Model.
b. Solving queries using different formal and informal query languages

Week 4:

Implement Queries using operators like :

a. Logical operators
b. Relational operators
c. Comparison operators

	Implement Queries using functions like : a. Aggregate functions b. String functions c. date/time functions d. Mathematical functions e. Sorting **Week 5:** Implement Nested Queries using operators a. Set comparison operators b. Correlated sub queries c. Group By Clause d. Having Clause e. Set operators **Week 6:** To implementation the concept of (a) joins (b) Views(c) Indexes (d)Commit (e)Save point (f)Rollback **Week 7:** PL /SQL programming: Blocks, Operators and Control structures **Week 8:** PL /SQL programming: Triggers, Functions and Procedures **Week 9:** Case Study on a given application: Refine the schemas up to 4th normal form. (Mini Project). **Week 10:** Installing , Configuring and Execution of MongoDBNoSQL **Week 11:** Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators) **Week 12:** Implement aggregation and indexing with suitable example using MongoDB
Text books and Reference books	[1]. Sanjay Mishra, Alan eaulieu, "Mastering Oracle SQL Paperback ", 2nd edition ,O'Reilly Media, 2004. [2]. Steven Feuerstien,"Oracle Pl/SQL Best Practices, 2/E (Covers Oracle Database11G)", O'Reilly Media ,2007. [3]. Karl seguin, "The Little MongoDBBooK", 2/E version 2.6, 2011.

E-resources and other digital material	[1]. ShyamalalKumawat,(09,05,2015). MYSQL.https://www.youtube.com/watch?v=XiDnK9Lq-Ng [2]www.techgig.com/practice/Specializations/Databases [3] www.w3schools.com/sql/ [4] https://www.tutorialspoint.com/sql/index.htm

20IT4353-ADVANCED PROGRAMMING LAB-I

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Lab	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	**20ES1103** Programming for Problem Solving **20ES2103** Object Oriented Programming using Python	**Continuous Evaluation:**	30
		Semester End Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Demonstrate the knowledge of problem solving and to find solutions that use different types of programming paradigms.
	CO2	Apply the knowledge of number theory to solve problems and generatesolutions
	CO3	Design solutions to the problems by applying linear and non-linear data structures
	CO4	Develop combinatory solutions to the real world problems
	CO5	Execute basic algorithmic ideas using greedy approach to solve competitive programming problems
	CO6	Analyze dynamic programming approaches to generate solution to the problems

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	M	M			M					H	H	M	H
CO2	L	M	M			M					M	M	L	L
CO3	H	M	H			M					H	H	H	H
CO4	L	M	M			M					M	M	L	L
CO5	H	M	H			H					H	H	H	H
CO6	H	M	H			H					H	H	H	H

Course Content

Week 1: Understand and identify the time complexity of a real world problem

a. Identify the time complexity of loops and write it in asymptotic notations
b. Solve the real world array problems and find their time complexities

Week 2& 3: Design Solutions using searching and sorting algorithms

a. Solve programs from different coding platforms to make use of searching and sorting algorithms

	Week 4: Derive solutions to problems that make use of Graph algorithms a. Design and develop programs using Depth and breadth first search algorihtms b. Identify the solutions using Warshalls and Bellman Ford's alogirthms **Week 5, 6 & 7: Identify the need and importance in the use of Greedy and dynamic algorithms in problem solving** a. Apply greedy technique to find the solutions to real world problems **Week 8:Programs on the implementation of methods and operations of data structures of Python** a. Practice all the methods of all the data structures from python **Week 9& 10: Implement programs to solve the problems using String manipulation and string matching algorithms** a. Design solutions by make use of string manipulation and matching algorithms **Week 11 &12: Solve programming problems based on math and combinatorics** a. Modular arithmetic b. Modular exponentiation and multiplicative inverse c. Greatest common Divisor d. Mike and Matrix Game e. Sum of Series and other problems
Text books and Reference books	**Text Book(s):** [1]. Halim, Steven and Halim, Felix, Competitive Programming 1, 2013 [2]. ReemaThareja,"Python ProgrammingUsing Problem Solving Approach", Oxford University Press, 2019. **Reference Books:** [1]. AnttiLaaksonen, "Guide to Competitive Programming", 1st edition, Springer International Publishing, 2017 [2]. Ahmed ShamsulArefin, Art of Programming Contest, ACMSolver, Second Edition, 2012 [3]. Zed Shah, "Learn PythonThe Hard Way", Third edition, Addison-Wesley, 2013. [4]. John V. Guttag, "Introduction to Computation and Programming Using Python", The MIT Press, 2013
E-resources and other digital material	[1]. FilippRukhovich, Competitive Programming for beginners, [COURSERA]. (19-05-2021), Available: https://www.coursera.org/learn/competitive-programming-for-beginners [2]. Prof Neeldhara, IIT Gandhinagar, Getting Started with Competitive Programming,[NPTEL],(19-05-2021),Available :https://onlinecourses.nptel.ac.in/noc21_cs99/preview [3]. Prof. Erik Demaine,Prof. Ronald Rivest,Prof. SriniDevadas MIT Open Courseware, Introduction to Algorithms, Getting Started with Competitive Programming,[MIT],

(19-05-2021),Available:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-spring-2008/index.htm
[4]. Hacker Rank, 19-05-2021 Available https://www.hackerrank.com/
[5]. Leet Code, 19-05-2021 Availablehttps://leetcode.com/
[6]. Hacker Earth, 19-05-2021 Available https://www.hackerearth.com/
[7]. Topcoder, 19-05-2021 Available https://www.topcoder.com/challenges/
[8]. Coder Byte, 19-05-2021 Available https://www.coderbyte.com/
[9]. .Code wars, 19-05-2021 Available https://www.codewars.com/
[10]. Code Signals, 19-05-2021 Available https://codesignal.com/
[11]. Code Chef, 19-05-2021 Available https://www.codechef.com/

20TP4106 ENGLISH FOR PROFESSIONALS

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practice	**Lecture-Tutorial-Practice:**	0 - 0- 2
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester End Evaluation:	0
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Present themselves effectively in the professional world by shedding off their inhibitions about communicating in English
	CO2	Introduce themselves as well as others appropriately
	CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills
	CO4	Involve in practical activity oriented sessions and respond positively by developing their analytical thinking skills.
	CO5	Learn about various expressions to be used in different situations.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, Medium-M, H- High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1										H	H			
CO2										H	H			
CO3										H	H			
CO4								M		H	H			

Course Content

UNIT I

1.Beginners, Functional, Situational Conversations: Introduction, Importance of spoken English in the placements and Group Discussion Beginners Conversation, Self Introduction-Introducing Self, Introducing each other in a team (Pair Activity) Functional Conversation, Seeking Permission from Seniors Teachers and other superiors (Team Activity), Asking Direction-Direction from stranger or from Helpline, Making Requests, Requests for borrowing books, applications, or any other help from office staff in college or outside.

2. Just a minute: Give a topic and ask the student to talk impromptu, To present the topic in a structured manner.3

UNIT II

3. Structuring and forming sentences: Structure of mother tongue and pit falls in translation to English, Formation of sentences in English

4. Errors in Usage: Difficulty in right usage of words, Difficulty in Pronunciation-Phonetic differences in mother tongue and English –areas to improve, Idioms and Phrase –Frequently used Idiom and Phrases which help to enhance the quality of

	presentation and make the presentation meaningful, Meaning of frequently used Idioms and Phrases.
	UNIT III **5. Introduction to different ways of speaking:** Elocution, Debate and Extempore, Principles of Elocution and its challenges practice in session, Principles of Debates and its challenges –practice session, Principles of Extempore - its pitfalls- practice sessions.
	UNIT IV **7. Etiquette:** Need of Etiquette in Social arena, Dining Etiquette, Social Etiquette in conversation -formal and informal gathering, Book a table etc. **8. Versant Test:** Mode of versant Test, Aim of the test and various methods it follows, Practice session.
Self-Study	
Text books and Reference books	**Text Book(s):** **Reference Books:** [1]. KamaleshSadanand, "A Spoken English", VOL 1&2; Orient BlackSwan, Second Edition,2014. [2]. "Communicative English"; Pearson; 2010
E-resources and other digital material	

20MC4108B INDIAN CONSTITUTION

Course Category:	Humanities elective	**Credits:**	1
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Know the fundamental law of the land
	CO2	Understand how fundamental rights are protected
	CO3	Perceive the structure and formation of the Indian Government System
	CO4	Explain when and how an emergency can be imposed and what are the consequences.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, H-High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1										M				
	CO2														
	CO3							L							
	CO4							M					H		

Course Content	**UNIT I:** **Introduction to Constitution of India:** Meaning of the Constitution Law and Constitutionalism, Historical perspective of constitution of India, Salient features of Constitution of India.
	UNIT II: **Fundamental rights**: Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under Article 19, scope of the right of life and personal liberty under Article 21, writs jurisdiction

	UNIT III: **Nature of the Indian constitution:** Federal structure and distribution of legislative and financial powers between the Union and states **Parliamentary form of government in India:** The Constitution powers and status of the President of India, Amendment of the Constitutional powers and Procedure, Historical Perspectives of the constitutional amendments in India **Local Self Government:** Constitutional Scheme in India
	UNIT IV: **Emergency Provisions:** National Emergency, President rule, financial emergency
Text books and Reference books	**Text Book(s):** [1] Dr. J.N. Pandey, Constitutional Law of India published by Central law Agency, Allahabad, Edition 2018 **Reference Books**: [1] V.N Shukla's, Constitution of India Eastern Book Company, Lucknow. [2] M.P. jain, Indian Constitution Law, Wadhwa and Company, Nagpur. [3] D.D. basu, Constitution of India, Wadhwa and Company, Nagpur.