SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

INTERNET OF THINGS

III & IV Semester

Effective for the students admitted in year 2020-21 and onwards.

Approved by 7th AC Meeting held on 1st Nov. 2021 (Agenda 7.5)

Office: Bikaner Technical University, Bikaner
Karni Industrial Area, Pugal Road, Bikaner-334004
Website: https://btu.ac.in

Dean Academics
Bikaner Technical University
Bikaner

B.Tech.: Internet of Things
2nd Year - III Semester

S.No.	Category	Course Code	Course Title	Contact hrs./week L	T	P	Marks Exam Hrs.	IA	ETE	Total	Cr
THEORY											
1	BSC	3IO2-01	Advanced Engineering Mathematics	3	0	0	3	30	120	150	3
2	HSMC	3IO1-02/ 3IO1-03	Technical Communication/ Managerial Economics and Financial Accounting	2	0	0	2	20	80	100	2
3	ESC	3IO3-04	Digital Electronics	3	0	0	3	30	120	150	3
4	PCC	3IO4-05	Data Structures and Algorithms	3	0	0	3	30	120	150	3
5		3IO4-06	Object Oriented Programming	3	0	0	3	30	120	150	3
6		3IO4-07	Data Communication and Computer Networks	3	0	0	3	30	120	150	3
Sub Total				**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	ESC	3IO3-21	Digital Electronics Lab	0	0	3	2	45	30	75	1.5
8	PCC	3IO4-22	Data Structures and Algorithms Lab	0	0	3	2	45	30	75	1.5
9		3IO4-23	Object Oriented Programming Lab Using C++	0	0	3	2	45	30	75	1.5
10		3IO4-24	Network Programming Lab	0	0	3	2	45	30	75	1.5
11	PSIT	3IO7-30	Industrial Training	0	0	1		0	0	50	1
12	Anandam	3IO8-00	ANANDAM							100	2
			Sub- Total	0	0	13		180	120	450	9
TOTAL OF III SEMESTER				**17**	**0**	**13**		**350**	**800**	**1300**	**26**

L: Lecture, **T**: Tutorial, **P**: Practical, **Cr**: Credits
ETE: End Term Exam, **IA**: Internal Assessment

B.Tech.: Internet of Things
2nd Year - IV Semester

S.No.	Category	Course		Contact hrs./week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
THEORY											
1	BSC	4IO2-01	Discrete Mathematics Structure	3	0	0	3	30	120	150	3
2	HSMC	4IO102/ 4IO1-03	Technical Communication/ Managerial Economics and Financial Accounting	2	0	0	2	20	80	100	2
3	ESC	4IO3-04	Database Management System	3	0	0	3	30	120	150	3
4	PCC	4IO4-05	Computer Architecture and Organization	3	0	0	3	30	120	150	3
5		4IO4-06	Theory of Computation	3	0	0	3	30	120	150	3
6		4IO4-07	Introduction to IOT	3	0	0	3	30	120	150	3
Sub Total				**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	ESC	4IO3-21	Database Management System Lab	0	0	3	2	45	30	75	1.5
8	PCC	4IO4-22	Python Programming Lab	0	0	3	2	45	30	75	1.5
9		4IO4-23	Sensors and Devices Lab	0	0	3	2	45	30	75	1.5
10		4IO4-24	Java Programming	0	0	3	2	45	30	75	1.5
11	Anandam	4IO8-00	ANANDAM							100	2
			Sub- Total	0	0	12		180	120	400	8
TOTAL OF IV SEMESTER				**17**	**0**	**12**		**350**	**800**	**1250**	**25**

L: Lecture, **T**: Tutorial, **P**: Practical, **Cr**: Credits
ETE: End Term Exam, **IA**: Internal Assessment

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Approved by 7th AC Meeting held on 1st Nov. 2021 (Agenda 7.5).

SYLLABUS OF UNDERGRADUATE DEGREE COURSE

INTERNET OF THINGS

III & IV Semester

Effective for the students admitted in year 2020-21 and onwards.

Approved by 7th AC Meeting held on 1st Nov. 2021 (Agenda 7.5)

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3IO2-01: Advanced Engineering Mathematics

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Random Variables:** Discrete and Continuous random variables, Joint distribution, Probability distribution function, conditional distribution. Mathematical Expectations: Moments, Moment Generating Functions, variance and correlation coefficients, Chebyshev's Inequality, Skewness and Kurtosis.	7
2	**Distributions**: Binomial distribution, Normal Distribution, Poisson Distribution, and their relations, Uniform Distribution, Exponential Distribution. **Correlations**: Karl Pearson's coefficient, Rank correlation. Curve fitting. Line of Regression.	5
3	Historical development, Engineering Applications of Optimization, Formulation of Design Problems as a Mathematical Programming Problems, Classification of Optimization Problems	8
4	**Classical Optimization using Differential Calculus:** Single Variable and Multivariable Optimization with & without Constraints, Langrangian theory, Kuhn Tucker conditions	6
5	**Linear Programming**: Simplex method, Two Phase Method and Duality in Linear Programming. Application of Linear Programming: Transportation and Assignment Problems.	14
	TOTAL	40

Suggested Books

- Higher Engineering Mathematics B S grewal Khanna Publisher
- Advance Engineering Mathematics R K jain and SRK Ayngar. Narosa Publication
- Advance Engineering Mathematics H K Dass S chand Publication.
- Advance Engineering Mathematics Erwin kreyszig Willey publication

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3IO1-02: Technical Communication

Credit: 2	Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P	End Term Exams: 2hr

S.No.	Contents	Hours
1	**Introduction to Technical Communication**- Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4
2	**Comprehension of Technical Materials/Texts and Information Design & development**- Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
3	**Technical Writing, Grammar and Editing-** Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, and Minutes of Meetings.	8
4	**Advanced Technical Writing-** Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	TOTAL	26

Suggested Books

- Effective Technical Communication, M Ashraf Rizvi, McGraw Hill Education (India) Private limited
- Technical Communication A Practical Approach, William Sanborn Pfeiffer Pearson Education India

3IO1-03: Managerial Economics and Financial Accounting

Credit: 2		Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P		End Term Exams: 2hr
S.No.	**Contents**	**Hours**
1	**Basic economic concepts** - Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts, and measurement.	4
2	**Demand and Supply analysis**- Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	**Production and Cost analysis**- Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	**Market structure and pricing theory**- Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	**Financial statement analysis**- Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds- flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
TOTAL		**26**

Suggested Books

- M. KAsi Reddy and S. Saraswati, Managerial Economics and Financial Accounting, Prentice Hall India Learning Private Limited, 2007.
- P, Vijaya Kumar and N. Appa Rao, Managerial Economics & Financial Analysis, Cengage, 1st edition, 201
- SA Siddiqui and AS Siddiqui, Managerial Economics and Financial Analysis, New Age International (P) Ltd Publishers, 2nd Edition, 2017
- A R Aryasri, Managerial Economics and Financial Analysis, by, The McGraw-Hill Publishing Company Limited, Delhi, Third Edition, 2007
- M S Bhat and A V Rau, Managerial Economics and Financial Analysis, BS Publications, 2016

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3IO3-04: Digital Electronics

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Fundamental concepts**: Number systems and codes, Basic logic Gates and Boolean algebra: Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra.	8
2	**Minimization Techniques and Logic Gates**: Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions– Quine - McCluskey method of minimization.	8
3	**Digital Logic Gate Characteristics**: TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS& CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET.	8
4	**Combinational Circuits**: Combinational logic circuit design, adder, subtractor, BCD adder encoder, decoder, BCDto7-segment decoder, multiplexer demultiplexer.	8
5	**Sequential Circuits**: Latches, Flip-flops - SR, JK, D, T, and Master-Slave Characteristic table and equation, counters and their design, Synchronous counters – Synchronous Up/Down counters – Programmable counters – State table and state transition diagram, sequential circuits design methodology. Registers –shift registers.	8
	TOTAL	40

Suggested Books

- Digital integrated electronics, By Herbert Taub, Donald L. S hilling, TMH
- Digital Logic and Computer Design By M. Morris Mano, Pearson
- Modern Digital Electronics By R.P. Jain, TMH
- Fundamentals of Digital circuits By A. Anand kumar, PHI
- Digital circuit design By S. Salivahanan, Sarivazhagan, Vikas publications

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3IO4-05: Data Structures and Algorithms

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Stacks:** Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	8
2	**Queues**: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues- Round Robin Algorithm. Circular Queues, Dequeue Priority Queues. Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, reversing a single linked list, Advantages and disadvantages of single linked list, circular linked list, double linked list and Header linked list.	8
3	**Searching Techniques**: Sequential and binary search. Sorting Techniques: Basic concepts, sorting by bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, radix sort and counting sorting algorithms.	8
4	**Trees:** Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree, B+ tree, AVL tree, Threaded binary tree.	8
5	**Graphs:** Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree (Prims &Kruskal), Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculation techniques, and Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	8
	TOTAL	40

Suggested Books

- An Introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH.
- Data Structures in C/C++, Tanenbaum, Pearson.
- Data Structures and Algorithms, Aho and Ullman .
- Data Structures – Horowitz Sahani PHI.
- Data Structures – Lipshutz TMH.

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3IO4-06: Object Oriented Programming

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	**Contents**	**Hours**
1	Introduction to different programming paradigm, characteristics of OOP, Class, Object, data member, member function, structures in C++, different access specifiers, defining member function inside and outside class, array of objects.	8
2	Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function overloading, function with default arguments, constructors and destructors, friend function and classes, using this pointer.	8
3	Inheritance, types of inheritance, multiple inheritance, virtual base class, function overriding, abstract class and pure virtual function.	9
4	Constant data member and member function, static data member and member function, polymorphism, operator overloading, dynamic binding, and virtual function.	9
5	Exception handling, Template, Stream class, File handling.	6
	TOTAL	40

Suggested Books

- C++ How to Program, 10/e. by Paul Deitel and Harvey Deitel. © 2016 Pearson Education. ISBN-13: 978-(13-444823-7 ISBN-10: 0-13-444823-5
- Balagurusamy E., "Object oriented programming with C++", Fifth Edition, Third Reprint, Tata McGraw Hill Education 2011.
- Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition, Reprint 2004.
- Lippman S. B., Josee Lajoie, Barbara E. Moo, "C++ Primer", Fourth Edition, Pearson Education, 2005.

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3IO4-07: Data communication and Computer Networks

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course **Introductory Concepts:** Network hardware, Network software, topologies, Protocols and standards, OSI model, TCP model, TCP/IP model, Physical Layer: Digital and Analog Signals, Periodic Analog Signals, Signal Transmission, Limitations of Data Rate, Digital Data Transmission, Performance Measures, Line Coding, Digital Modulation, Media and Digital Transmission System.	8
2	**Data Link Layer**: Error Detection and Correction, Types of Errors, Two dimensional parity check, Detection verses correction, Block Coding, Linear Block Coding, Cyclic Codes, Checksum, Standardized Polynomial Code, Error Correction Methods, Forward Error Correction, Protocols: Stop and wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding window, Piggy backing, Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA.	8
3	**Network Layer:** Design issues, Routing algorithms, IPV4, IPV6, Address mapping: ARQ, RARQ, Congestion control, Unicast, Multicast, Broadcast routing protocols, Quality of Service, Internetworking.	8
4	**Transport Layer**: Transport service, Elements of transport protocols, User Datagram Protocol, Transmission Control Protocol, Quality of service, Leaky Bucket and Token Bucket algorithm.	8
5	**Application Layer**: WWW, DNS, Multimedia, Electronic mail, FTP, HTTP, SMTP, Introduction to network security.	8
	TOTAL	40

Suggested Books

- Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2013.
- James Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3 Edition, Pearson Education.
- William Stallings , "Data and Computer Communications", 8th edition, Pearson Education.
- Behrouz A. Forouzan , "Data Communications and Networking", 5th Edition, McGraw Hill Education.
- Larry Peterson and Bruce Davie , "Computer Networks: A Systems Approach", 4th Edition, Morga Kaufmann Publishers | Elsevier.

3IO3-21: Digital Electronics Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S. No.	Contents
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also, to verify truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs).
2	To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND& NOR gates.
3	To realize an SOP and POS expression.
4	To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.
5	To realize a 4-bit ripple adder/ Subtractor using basic Half adder/ Subtractor & basic Full Adder/ Subtractor.
6	To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also, to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7	Design & realize a combinational circuit that will accept a 2421 BCD ode and drive a TIL - 312 seven-segment displays.
8	Using basic logic gates, realize the R-S, J-K and D- flip flops with and without clock signal and verify their truth table.
9	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using lo k. Also exercise loading only one of multiple values into the register using multiplexer. Note: As far as possible, the experiments shall be performed on bread board. However, experiment Nos. 1-4 are to be performed on bread board only.

Suggested Books

- Digital integrated electronics, By Herbert Taub, Donald L. S hilling, TMH
- Digital Logic and Computer Design By M. Morris Mano, Pearson
- Modern Digital Electronics By R.P. Jain, TMH
- Fundamentals of Digital circuits By A. Anand kumar, PHI
- Digital circuit design By S. Salivahanan, Sarivazhagan, Vikas publications

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3IO4-22: Data Structures and Algorithms Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S. No.	Contents
1	Write a simple C program on a 32-bit compiler to understand the concept of array storage, size of a word. The program shall be written illustrating the concept of row major and column major storage. Find the address of element and verify it with the theoretical value. Program may be written for arrays up to 4-dimensions.
2	Simulate a stack, queue, circular queue and dequeue using a one-dimensional array as storage element. The program should implement the basic addition, deletion and traversal operations.
3	Represent a 2-variable polynomial using array. Use this representation to implement addition of polynomials.
4	Represent a sparse matrix using array. Implement addition and transposition operations using the representation.
5	Implement singly, doubly, and circularly connected linked lists illustrating operations like addition at different locations, deletion from specified locations and traversal.
6	Repeat exercises 2, 3 & 4 with linked structure.
7	Implementation of binary tree with operations like addition, deletion, traversal.
8	Depth first and breadth first traversal of graphs represented using adjacency matrix and list.
9	Implementation of binary search in arrays and on linked Binary Search Tree.
10	Implementation of different sorting algorithm like insertion, quick, heap, bubble and many more sorting algorithms.

Suggested Books

- Nell B Dale,"C++ data structures",ISBN-10: 1449646751, 5-th edition.
- Data Structures – Horowitz Sahani PHI
- Data Structures – Lipshutz TMH

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3IO4-23: Object Oriented Programming Lab Using C++

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S. No.	Contents
1	Understand the basics of C++ library, variables, data input-output.
2	C++ program using with the concept of structures.
3	Implement class and object concepts and function overloading.
4	Write programs to understand dynamic memory allocation and array of objects.
5	Program to understand different types of constructors and destructor.
6	Implement friend function to access private data of a class and usage of this pointer.
7	Write programs to understand the usage of constant data member and member function, static data member and member function in a class.
8	Implement different types of inheritance, function overriding and virtual Function
9	Implement Operator overloading concepts.
10	Write programs to understand function template and class template.
11	Write programs to understand exception handling techniques.
12	Write programs to understand file handling techniques.

Suggested Books

- C++ How to Program, 10/e. by Paul Deitel and Harvey Deitel. © 2016 Pearson Education. ISBN-13: 978-(13-444823-7 ISBN-10: 0-13-444823-5
- Balagurusamy E., "Object oriented programming with C++", Fifth Edition, Third Reprint, Tata McGraw–Hi Education 2011.
- Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition, Reprint 2004.
- Lippman S. B., Josee Lajoie, Barbara E. Moo, "C++ Primer", Fourth Edition, Pearson Education, 2005

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3IO4-24: Network Programming Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S.No.	Contents
1	Study of Different Type of LAN& Network Equipment.
2	Study and Verification of standard Network topologies i.e. Star, Bus, Ring etc.
3	LAN installations and Configurations.
4	Write a program to implement various types of error correcting techniques.
5	Write a program to implement various types of framing methods.
6	Write two programs in C: hello_client and hello_server a. The server listens for, and accepts, a single TCP connection; it reads all the data it can from that connection, and prints it to the screen; then it closes the connection b. The client connects to the server, sends the string "Hello, world!", then closes the connection
7	Write an Echo_Client and Echo_server using TCP to estimate the round-trip time from client to the server. The server should be such that it can accept multiple connections at any given time.
8	Repeat Exercises 6 & 7 for UDP.
9	Repeat Exercise 7 with multiplexed I/O operations.
10	Study and basic TCP/UDP traffic implementation in NS3.
11	Simulate Bellman-Ford Routing algorithm in NS3.

Suggested Books

- W. Richard Steavens, Bill Fenner, Andrew M. Rudoff, "Unix Network Programming Volume 1: The S: Th Sockets Networking API - Vol. 1", 3rd edition, Pearson Education India
- Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2013.
- James Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3 Edition, Pearson Education.
- William Stallings , "Data and Computer Communications", 8th edition, Pearson Education.
- Behrouz A. Forouzan , "Data Communications and Networking", 5th Edition, McGraw Hill Education.
- Larry Peterson and Bruce Davie , "Computer Networks: A Systems Approach", 4th Edition, Morga Kaufmann Publishers | Elsevier.

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4IO2-01: Discrete Mathematics Structure

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Introduction:** Objective, scope, and outcome of the course.	1
2	**Set Theory:** Definition of sets, countable and uncountable sets, Set operations, Partition of set, Cardinality (Inclusion-Exclusion & Addition Principles) Venn Diagrams, proofs of some general identities on sets. **Relation:** Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Partial ordering relation, Job-Scheduling problem. **Function:** Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle. Theorem proving Techniques: Mathematical induction, Proof by contradiction. Composition of Functions. The Pigeonhole and Generalized Pigeonhole Principles.	7
3	**Propositional Logic:** Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers. 2-way predicate logic. Introduction to finite state machine Finite state machines as models of physical system equivalence machines, Finite state machines as language recognizers.	8
4	**Posets, Hasse Diagram and Lattices:** Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices. **Combinatorics:** Introduction, Permutation and combination, Binomial Theorem, Multimodal Coefficients Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions,Ggenerating functions, Solution by method of generating functions.	8
5	**Algebraic Structures:** Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.	8
6	**Graph Theory:** Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs, matching, vertex/edge covering.	8
	TOTAL	40

Suggested Books

- A. Singaravelu, M. P. Jeyaraman, "Discrete Mathematics", Meenakshi Agency, 2013.
- Kenneth H. Roshan, "Discrete Mathematics and its Applications", Tata McGraw Hill, 2011.
- Trembly J.P and Monohar R, "Discrete Mathematical Structures with Applications to Computer Science' Tata McGraw Hill, 2003.
- Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", Joh Wiley and Sons, 2nd Edition, 2002.
- J. A. Bondy and U.S.R Murty, "Graph Theory", Springer, 2008.

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4IO1-02: Technical Communication

Credit: 2	Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P	End Term Exams: 2hr

S.No.	Contents	Hours
1	**Introduction to Technical Communication**- Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4
2	**Comprehension of Technical Materials/Texts and Information Design & development**- Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting, and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
3	**Technical Writing, Grammar and Editing-** Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting, and writing Official Notes, Letters, E-mail, Resume, Job Application, and Minutes of Meetings.	8
4	**Advanced Technical Writing-** Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	TOTAL	26

Suggested Books

- Effective Technical Communication, M Ashraf Rizvi , McGraw Hill Education (India) Private limited
- Technical Communication A Practical Approach, William Sanborn Pfeiffer Pearson Education India

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4IO1-03: Managerial Economics and Financial Accounting

Credit: 2	Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P	End Term Exams: 2hr

S.No.	Contents	Hours
1	**Basic economic concepts** - Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	4
2	**Demand and Supply analysis**- Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	**Production and Cost analysis**- Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	**Market structure and pricing theory**- Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	**Financial statement analysis**- Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds- flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	TOTAL	26

Suggested Books

- M. KAsi Reddy and S. Saraswati, Managerial Economics and Financial Accounting, Prentice Hall India Learning Private Limited, 2007.
- P, Vijaya Kumar and N. Appa Rao, Managerial Economics & Financial Analysis , Cengage, 1st edition, 2011
- SA Siddiqui and AS Siddiqui, Managerial Economics and Financial Analysis, New Age International (P) Ltd Publishers, 2nd Edition, 2017
- A R Aryasri, Managerial Economics and Financial Analysis, by, The McGraw-Hill Publishing Company Limited, Delhi, Third Edition, 2007
- M S Bhat and A V Rau, Managerial Economics and Financial Analysis, BS Publications, 2016

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4IO3-04: Database Management System

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction to database systems:** Overview and History of DBMS. File System v/s DBMS. Advantage of DBMS Describing and Storing Data in a Masquerades in DBMS. Structure of a DBMS. Entity Relationship model: Overview of Data Design Entities, Attributes and Entity Sets, Relationship and Relationship Sets. Features of the ER Model- Key Constraints, Participation Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Data Base, and Design with ER Model- Entity v/s Attribute, Entity vs Relationship Binary vs Ternary Relationship and Aggregation v/s ternary Relationship Conceptual Design for a Large Enterprise.	7
3	**Relationship Algebra and Calculus**: Relationship Algebra Selection and Projection, Set Operations, Renaming, Joints, Division, Relation Calculus, Expressive Power of Algebra and Calculus. SQL queries programming and Triggers: The Forms of a Basic SQL Query, Union, and Intersection and Except, Nested Queries, Correlated Nested Queries, Set-Comparison Operations, Aggregate Operators, Null Values and Embedded SQL, Dynamic SQL, ODBC and JDBC, Triggers and Active Databases.	8
4	**Schema refinement and Normal forms:** Introductions to Schema Refinement, Functional Dependencies, Boyce-Codd Normal Forms, Third Normal Form, Normalization-Decomposition into BCNF Decomposition into 3-NF.	8
5	**Transaction Processing:** Introduction-Transaction State, Transaction properties, Concurrent Executions. Need of Serializability, Conflict vs. View Serializability, Testing for Serializability, Recoverable Schedules, Cascade less Schedules.	8
6	**Concurrency Control:** Implementation of Concurrency: Lock-based protocols, Timestamp-based protocols, Validation-based protocols, Deadlock handling, Database Failure and Recovery: Database Failures, Recovery Schemes: Shadow Paging and Log-based Recovery, Recovery with Concurrent transactions.	8
	TOTAL	40

Suggested Books

- Abraham Silberschatz, Henry F. Korth and S. Sudarshan- —Database System Concepts, Sixth Editio McGraw-Hill, 2011.
- Ramez Elmasri and Shamkant B. Navathe, —Fundamental Database Systemsl, Seventh Edition, Pearso Education,2016.
- Raghu Ramakrishnan,Database Management System, Tata McGraw-Hill Publishing Company, 3rd Editio 2014.
- Jiawei Han, Micheline Kamber, Jian Pei -Data Mining Concepts and Techniques, Morgan Kaufmann, Thir Edition, 2012

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Approved by 7th AC Meeting held on 1st Nov. 2021 (Agenda 7.5).

4IO4-05: Computer Architecture and Organization

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Introduction:** Objective, scope, and outcome of the course.	01
2	**Computer Data Representation:** Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit. Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit.	10
3	**Programming The Basic Computer:** Introduction, Machine Language, Assembly Language, assembler, Program loops, Programming Arithmetic and logic operations, subroutines, I-O Programming. Micro programmed Control: Control Memory, Address sequencing, Micro program Example, design of control Unit	7
4	**Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC)Pipeline and Vector Processing, Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors	8
5	Computer Arithmetic: Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit. Input-Output Organization Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor(IOP), CPUIOP Communication, Serial Communication.	8
6	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.	8
	TOTAL	42

Suggested Books

- William stallings, "Computer Organization and Architectue, PHI" 2. M. Morris Mano,
- M. Morris Mano, "Computer System Architecture" , PHI
- J.D. Carpinelli, "Computer Systems Organization and Architecture," Pearson Education
- Heuring and Jordan, Pearson Education, "Computer Systems Design and Architecture"
- Tor M. Aamodt, Wilson Wai Lun Fung, Timothy G. Rogers General-Purpose Graphics Processo Architecture

4IO4-06: Theory of Computation

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Finite Automata & Regular Expression:** Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and non- deterministic finite automation, Equivalence of DFA and NDFA, Decision properties, minimization of finite automata, Mealy & Moore machines. Alphabet, words, Operations, Regular sets, relationship and conversion between Finite automata and regular expression and vice versa, designing regular expressions, closure properties of regular sets, Pumping lemma and regular sets, Myhill- Nerode theorem, Application of pumping lemma, Power of the languages.	8
2	**Context Free Grammars (CFG),** Derivations and Languages, Relationship between derivation and derivation trees, leftmost and rightmost derivation, sentential forms, parsing and ambiguity, simplification of CFG, normal forms, Greibach and Chomsky Normal form, Problems related to CNF and GNF including membership problem.	**8**
3	**Nondeterministic PDA, Definitions,** PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL, the pumping lemma for CFL's, Closure Properties and Decision properties for CFL, Deciding properties of CFL.	**8**
4	**Turing Machines:** Introduction, Definition of Turing Machine, TM as language Acceptors and Transducers, Computable Languages and functions, Universal TM & Other modification, multiple tracks Turing Machine. Hierarchy of Formal languages: Recursive & recursively enumerable languages, Properties of RL and REL, Introduction of Context sensitive grammars and languages, The Chomsky Hierarchy.	**8**
5	**Tractable and Untractable Problems**: P, NP, NP complete and NP hard problems, Un-decidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling salesman problem.	**8**
	TOTAL	**40**

Suggested Books

- Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations Second Edition, Pearson Education.
- John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hi Publishing Company, New Delhi
- Marvin L. Minsky "Computation: Finite and Infinite" – Prentice Hall, 1967
- Michael Sipser "Introduction to the Theory of Computation" , Third Edition, 2012 Cengage Learning
- Peter Lenz – An Introduction to Formal languages and Automata – 3rd Edition Narosa, 2003
- Thomas A. Sukamp – An introduction to the theory of computer science languages and machines – 3rd editio Pearson Education, 2007.
- G E Reevsz "Introduction to Formal Languages" TMH, 2000

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4IO4-07: Introduction to IoT

Credit: 3	Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P	End Term Exams: 3hr

S.No.	Contents	Hours
1	**Internet of Things Promises–** Definition and characteristics of IoT – Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device **Design of IOT**: Physical design of IOT, Logical Design of IOT- Functional Blocks, communication models, communication APIs, IOT enabling Technologies- Wireless Sensor Networks, Cloud computing, big data analytics, embedded systems. IOT Levels and deployment templates.	7
2	**IoT Hardware and Software:** Arduino, Raspberry Pi, LiteOS, RIoTOS, Contiki OS, Tiny OS, , Printed Electronics, IoT Generation Roadmap, Wireless Sensor Structure, Energy Storage Module, Power Management Module, RF Module, Sensing Module	7
3	**IOT and M2M**: M2M, Difference and similarities between IOT and M2M, Software defined networks, network function virtualization, difference between SDN and NFV for IoT.	7
4	**Sensor and actuator:** Humidity sensors, Ultrasonic sensor, Temperature Sensor, Industrial sensors Description & Characteristics, First Generation, Advanced Generation, Integrated IoT Sensors, Polytronics Systems, Sensors' Swarm	7
5	**Architecture and Reference Model:** Introduction, Reference Model and architecture, Representational State Transfer (REST) architectural style, Uniform Resource Identifiers (URIs). Challenges in IoT- Design challenges, Development challenges, Security challenges, Other challenges.	7
6	**Case study of IoT Applications**: Domain specific IOTs- Home automation, Cities, environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyles.	7
	TOTAL	42

Suggested Books

- Internet of Things : A Hands-on Approach , by Arshdeep Bagha and Vijay Madisetti, Universities Press, 201 ISBN: 9788173719547
- The Internet of Things : Enabling Technologies, Platforms and Use Cases by Pethuru Raj and Anupama C Raman (CRC Press)
- Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Thing Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014
- Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,
- Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD 2016, ISBN 7989352133895
- Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
- Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publi 2014
- N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

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4IO3-21: Database Management System Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S.No.	Contents
1	To study Basic SQL commands (create table, use , drop, insert) and execute the following queries using these commands: (CO1) i. Create a table 'Emp' with attributes 'ename', 'ecity', 'salary', 'enumber', 'eaddress', 'depttname'. ii. Create another table 'Company' with attributes 'cname', ccity','empnumber' in the database 'Employee'
2	To study the viewing commands (select , update) and execute the following queries using these commands: i. Find the names of all employees who live in Delhi. ii. Increase the salary of all employees by Rs. 5,000. iii. Find the company names where the number of employees is greater than 10,000. iv. Change the Company City to Gurgaon where the Company name is 'TCS'.
3	To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands: i. Add an attribute named ' Designation' to the table 'Emp'. ii. Modify the table 'Emp', Change the datatype of 'salary' attribute to float. iii. Drop the attribute 'depttname' from the table 'emp'. iv. Delete the entries from the table ' Company' where the number of employees are less than 500.
4	To study the commands that involve compound conditions (and, or, in , not in, between , not between , like , not like) and execute the following queries using these commands: i. Find the names of all employees who live in ' Gurgaon' and whose salary is between Rs. ii. 20,000 and Rs. 30,000. iii. Find the names of all employees whose names begin with either letter 'A' or 'B'. iv. Find the company names where the company city is 'Delhi' and the number of employees v. is not between 5000 and 10,000. vi. Find the names of all companies that do not end with letter 'A'.
5	To study the aggregate functions (sum, count, max, min, average) and execute the following queries using these commands: i. Find the sum and average of salaries of all employees in computer science department. ii. Find the number of all employees who live in Delhi. iii. Find the maximum and the minimum salary in the HR department.
6	To study the grouping commands (group by, order by) and execute the following queries using these commands: i. List all employee names in descending order. ii. Find number of employees in each department where number of employees is greater than 5. iii. List all the department names where average salary of a department is Rs.10,000.
7	To study the commands involving data constraints and execute the following queries using these commands:

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	i. Alter table 'Emp' and make 'enumber' as the primary key. ii. Alter table 'Company' and add the foreign key constraint. iii. Add a check constraint in the table 'Emp' such that salary has the value between 0 and Rs.1,00,000 iv. Alter table 'Company' and add unique constraint to column cname v. Add a default constraint to column ccity of table company with the value 'Delhi'
8	To study the commands for joins (cross join, inner join, outer join) and execute the following queries using these commands: i. Retrieve the complete record of an employee and its company from both the table using joins. ii. List all the employees working in the company 'TCS'.
9	To study the various set operations and execute the following queries using these commands: iii. List the enumber of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true. i. List the enumber of all employees who live in Delhi but whose company is not in Gurgaon.
10	To study the various scalar functions and string functions (power, square, substring, reverse, upper, lower, concatenation) and execute the following queries using these commands: i. Reverse the names of all employees. ii. Change the names of company cities to uppercase. iii. Concatenate name and city of the employee.
11	To study the commands involving indexes and execute the following queries: i. Create an index with attribute ename on the table employee. ii. Create a composite index with attributes cname and ccity on table company. iii. Drop all indexes created on table company.
12	To study the conditional controls and case statement in PL-SQL and execute the following queries: i. Calculate the average salary from table 'Emp' and print increase the salary if the average salary is less that 10,000. ii. Display the deptno from the employee table using the case statement if the deptname is 'Technical' then deptno is 1, if the deptname is 'HR' then the deptno is 2 else deptno is 3.
13	To study procedures and triggers in PL-SQL and execute the following queries: i. Create a procedure on table employee to display the details of employee to display the details of employees by providing them value of salaries during execution. ii. Create a trigger on table company for deletion where the whole table is displayed when delete operation is performed.
14	Consider the tables given below. The primary keys are made bold and the data types are specified. PERSON(driver_id:string , name:string , address:string), CAR(regno:string , model:string , year:int) ACCIDENT(report_number:int , accd_date:date , location:string), OWNS(driver_id:string , regno:string),PARTICIPATED(driver_id:string , regno:string , report_number:int , damage_amount:int), i. Create the above tables by properly specifying the primary keys and foreign keys. ii. Enter at least five tuples for each relation. iii. Demonstrate how you Update the damage amount for the car with specific regno in the accident with report number 12 to 25000. iv. Find the total number of people who owned cars that were involved in accidents in the year 2008. v. Find the number of accidents in which cars belonging to a specific model were involved

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Suggested Books

- Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Editio McGraw-Hill, 2011.
- Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Seventh Edition, Pearso Education,2016

Data Base Designing Project: For better understanding students (group of 3-4 students) should design dat base for any data base project, understand the requirement and design methodology of project by its own.

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4IO4-22: Python Programming Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S.No.	Contents
1	Implement basic Python programs for reading input from console.
2	Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set.
3	Solve problems using decision and looping statements.
4	Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem.
5	Handle numerical operations using math and random number functions
6	Create user-defined functions with different types of function arguments.
7	Perform File manipulations- open, close, read, write, append and copy from one file to another.
8	Handle Exceptions using Python Built-in Exceptions
9	Solve problems using Class declaration and Object creation and Implement OOP concepts like Data hiding and Data Abstraction.
10	Intrinsic NumPy objects and Random Functions. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
11	Computation on NumPy arrays using Universal Functions and Mathematical methods.
12	Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
13	Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
14	Import any CSV file to Pandas DataFrame and perform the following: i. Handle missing data by detecting and dropping/ filling missing values. ii. Transform data using apply() and map() method. iii. Detect and filter outliers. iv. Perform Vectorized String operations on Pandas Series. v. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots

Suggested Books

- Starting Out with Python (2009) Pearson, Tonny Gaddis
- Beginning Pyhton Wrox Publication Peter Norton, Alex Samuel
- Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
- Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
- Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017

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4IO4-23: Sensors and Devices Lab

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S.No.	Contents
1	Connect an LED to GPIO pin 25 and control it through command line.
2	Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch.
3	The state of LED should toggle with every press of the switch Use DHT11 temperature sensor and print the temperature and humidity of the room with an interval of 15 seconds
4	Use joystick and display the direction on the screen
5	Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light.
6	Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds.
7	Switch on and switch of a DC motor based on the position of a switch.
8	Convert an analog voltage to digital value and show it on the screen.
9	Create a door lock application using a reed switch and magnet and give a beep when the door is opened.
10	Control a 230V device (Bulb) with Raspberry Pi using a relay.
11	Control a 230V device using a threshold temperature, using temperature sensor.
12	Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor).
13	Create a web application for the above applications wherever possible with suitable modifications to get input and to send output.

Warning: For AC (230V) appliance or bulb controller the experiment must be carried out cautiously

Suggested Books

- Internet of Things : A Hands-on Approach , by Arshdeep Bagha and Vijay Madisetti, Universities Press, 201 ISBN: 9788173719547
- The Internet of Things : Enabling Technologies, Platforms and Use Cases by Pethuru Raj and Anupama (Raman (CRC Press)
- Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Thing Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014
- Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN 9789350239759
- Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (S 2016, ISBN 7989352133895
- Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
- Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publi 2014
- N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

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4IO4-24: Java Programming

Credit: 1.5	Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P	End Term Exams: 2hr

S.No.	Contents
1	**Introductory Program** i. Write a program to print the individual digits of any 3-digit number. ii. Write a program to read N numbers and find the largest and smallest numbers. iii. Write a program to read an email as input and verify whether the email is in the correct format (***@***.**) using String functions iv. Write a program to display total marks of 5 students using student class. Given the following attributes: Regno(int), Name(string), Marks in subjects(Integer Array), Total (int).
2	**Inheritance, Packages And Interface** i. Write a program to create a player class. Inherit the classes Cricket_player, Football_player and Hockey_player form player class. ii. Write a program to show how a class implements two interfaces. iii. Write a program to create a package for Book details giving Book Name, Author Name, Price, year of publishing
3	**Exception Handling And Multithreading** i. Write a Java program to catch more than one exception. ii. Write a Java program for generating two threads, one for printing even umbers and other for printing odd numbers. iii. Write a Java program for producer and consumer problem using Thread.
4	**Input/Output Streams** i. Write a java program to copy the contents of one file to another file. ii. Write a Java program to read input from the standard input and write to a byte array.
5	**Working With Awt Classes, Swing, Applet And Graphics** i. Create an Applet to read the RGB components as input and create an appropriate colour using the RGB values. Fill a rectangle using the obtained colour. ii. Create an applet for simple calculator to perform Addition, Subtraction, Multiplication and Division using Button, label and Text field classes

Suggested Books

- Paul Deitel and Harvey Deitel "Java How to Program", 11th edition, Pearson, ISBN-10 : 9780134743356, ISBN-13 : 978-0134743356
- Herbert Schildt, "JAVA The Complete Reference", 10th Edition, McGraw Hill Education, 2017.
- Cay S. Horstman and Gary Cornell ,"Core Java Volume I—Fundamentals", 11th Edition, Prentice.