RAMAIAH
Institute of Technology

CURRICULUM

Academic Year 2023– 2024

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

III & IV Semester B. E.

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU)

BANGALORE – 54

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A⁺' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is also been conferred autonomous status for Ph.D program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 65% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 78ᵗʰ rank among 1249 top Engineering Institutions & 23ʳᵈ Rank for School of Architecture in India for the year 2023 and is 1ˢᵗ amongst the Engineering Colleges affiliated to VTU, Karnataka.

About the Department:

The Department of Information Science and Engineering (ISE) was established in the year 1992 with an objective of producing high quality professionals to meet the demands of the emerging field of Information Technology. Department offers Bachelor's program in Information Science and Engineering (B. E), Master's program in Data Science (MTech) and Doctoral program (Ph.D.). The Department of Information Science and Engineering, is a progressive department that has made significant contributions to Academics, Research and Innovation. Under Graduate (UG) is accredited by the National Board of Accreditation in 2001, 2004, 2010, 2015, 2018 and reaccredited in 2022 under Tier-1 till 2028. The department has highly qualified and competent faculty members committed to innovative teaching learning and quality research. Department has 8 well-equipped state of the art laboratories which meets the requirement of curriculum, innovation and research. Collaboration with industries such as Apple, Unisys, Mindtree, Intel, Google, SECO, IBM, NVIDIA etc, has a significant impact on the curriculum, computing infrastructure, teaching & learning and research. The curriculum is centered around Data Science, Artificial Intelligence, IOT, Cloud & Distributed Computing, System Programming, Computer Security and Software development. Curriculum and the teaching learning process ensure that the students demonstrate technical competence, ethical reasoning, creativity in identification & formulation of the problems and develop solutions by using appropriate tools & techniques. Department has established technical clubs/ professional student chapters to provide collaborative learning platform for the students. Echo system has been built to initiate start-ups/Innovation at the department level along with the mentorship program. The activities of the Department led to high profile placements, motivation to become an entrepreneur, and encouragement for higher learning.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at MS Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To evolve as an outstanding education and research center of Information Technology to create high quality Engineering Professionals for the betterment of Society

MISSION OF THE DEPARTMENT

Department of Information Science and Engineering shall create high quality IT Engineering Professionals for the betterment of society by:

- Providing education through an ever improving curriculum and effective pedagogy techniques.
- Encouraging extra and co-curricular activities to develop their overall personality along with technical skills.
- Collaborating with industry and academia for strengthening research, innovation and entrepreneurship ecosystem.

<h1 style="text-align: center;">PROGRAM EDUCATIONAL OBJECTIVES (PEOs)</h1>

PEO1: Become competent Information Technology professionals with continuous progress in career or learning.

PEO2: Productively engage with society by practicing research or entrepreneurship.

PEO3: Function effectively as professionals in a team environment or individually.

PROGRAM OUTCOMES (POs)

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

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

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

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

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply Mathematical models, programming paradigms and software development practices to solve real world problems

PSO2: Adopt computing and communication models for developing IT solutions.

PSO3: Acquire data engineering skills to develop intelligent systems in a multidisciplinary environment.

B.E. in Information Science and Engineering
Scheme of Teaching and Examination 2022-23
(Effective from the academic year 2022-23)

III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IS31	Laplace Transforms & Vector Space		BSC	2	1	0	3	4
2	IS32	Digital Systems and Computer Organization		IPCC	3	0	1	4	5
3	IS33	Data Structures		PCC	3	0	0	3	3
4	IS34	Operating Systems		PCC	3	0	0	3	3
5	IS35	Discrete Mathematical Structures		PCC	2	1	0	3	4
6	ISL36	Data Structures Lab		PCC	0	0	1	1	2
7	ISL37	Unix System Programming Lab		PCC	0	0	1	1	2
8	UHV38	Universal Human Value Course		UHV	2	0	0	2	2
9	ISAEC39X	Ability Enhancement Course- III		AEC	1	0	0	1	1
				Total	16	2	3	**21**	**25**
10	PE83	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VIII semesters. Qualifying is mandatory for the award of the degree.				
	YO83	Yoga							
	NS83	NSS							
12	AM31	Additional Mathematics - I *		NCMC	0	0	0	0	3

Ability Enhancement Course- III

S.No.	Subject code	Subject Name
1	ISAEC391	Green IT and sustainability
2	ISAEC392	Capacity planning in IT
3	ISAEC393	Numerical analysis with python

NOTE: Minimum of 1 subject should have a Tutorial component of 1 Credit.

Nomenclature: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **HSMC:** Humanity and Social Science & Management Courses, **AEC–**Ability Enhancement Courses, **UHV:** Universal Human Value Course, **NCMC**: Non-credit Mandatory Course

L –Lecture, T – Tutorial, P- Practical/ Drawing

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

The Non Credit Mandatory Course, Physical Education (Sport and Athletics)/Yoga/National Service Scheme (NSS):

1. Student shall select any one of the NCMC's namely, Physical Education (Sport and Athletics)/Yoga/ NSS prescribed for VIII semesters and shall attend the course from the III semesters and upto end of VIII semesters to complete all the formalities of the course and appear for the SEE. Marks scored in SEE shall be included in the VIII semester grade card.
2. The above mentioned NCMC's shall not be considered for vertical progression as well as for the calculation of SGPA/CGPA but completion of the courses shall be mandatory for the award of degree.
3. SEE marks will be allotted by the concerned course teacher based on attendance and performance in the practice sessions/field in the ratio of 50:50. Maximum CIE marks are 50. SEE should be awarded by the course teacher every semester (III to VIII) for 50 marks and marks scored by the student are scaled down to 50 in the VIII semester.
4. The students who take a course on Physical Education and Yoga, he/she has to take up the semester end practical examination prescribed for 100 marks. The students who opt for NSS course have to submit report and attend viva-voce examination. The marks of the report shall be 50 marks and for the presentation/viva-voce 50 marks. SEE scale down to 50 marks.
5. In case, any student fails to secure the minimum 40% of the prescribed marks, he/she shall be deemed to have secured **'F'** grade.

* Lateral Entry Students:

The Non-Credit Mandatory Course, Additional Mathematics I is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured **'F'** grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. Incase student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics I shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Inter/Intra Institutional Internship: All the students admitted under lateral entry category shall have to undergo a mandatory summer Internship-I of 03 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during IV semester and the prescribed credit shall be included in IV semester after students clearing this head. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements during subsequent semesters.

Lateral Entry Students:

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

		B.E. in Information Science and Engineering **Scheme of Teaching and Examination 2022-23** **(Effective from the academic year 2022-23)**							
IV SEMESTER									
Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IS41	Statistics, Probability and Linear Programming		BSC	2	1	0	3	4
2	IS42	Micro Controller		IPCC	3	0	1	4	5
3	IS43	Design and Analysis of Algorithms		PCC	3	0	0	3	3
4	IS44	Database Management Systems		PCC	3	0	0	3	3
5	IS45	Advanced Java		PCC	3	0	0	3	3
6	ISL46	Design and Analysis of Algorithms Lab		PCC	0	0	1	1	2
7	ISL47	Database Management Systems Lab		PCC	0	0	1	1	2
8	ISL48	Advanced Java Lab		PCC	0	0	1	1	2
9	ISAEC 49X	Ability Enhancement Course - IV		AEC	1	0	0	1	1
				Total	15	1	4	**20**	**25**
10	AM41	Additional Mathematics II *		NCMC	0	0	0	0	-

S.No.	Subject Code	Subject Name
1	ISAEC491	UI/UX

2	ISAEC492	Cybercrime and cyber laws
3	ISAEC493	JavaScript and JQuery

NOTE: Minimum of 1 subject should have a Tutorial component of 1 Credit.

Nomenclature: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT –** Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC–**Ability Enhancement Courses,

NCMC: Non-credit Mandatory Course

L –Lecture, T – Tutorial, P- Practical/ Drawing

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

Innovation/ Societal/ Entrepreneurship based Internship: At the End of fourth Semester four - weeks summer internship shall be carried out at industry, State and Central Govt./NGO/MSME, Innovation center's or incubation centers. The internship can be Rural Internship. All the students shall have to undergo mandatory internship of 04 weeks during the intervening period of IV & V semesters. A Viva-Voce examination (CIE) shall be conducted during V semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. The in-charge faculty has to monitor the student's internship progress and interact to guide them for the successful completion of the internship.

Innovation/ Societal/ Entrepreneurship based Internship shall have only CIE no SEE component.

* Lateral Entry Students:

The Non-Credit Mandatory Course, Additional Mathematics II is prescribed for IV Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during

the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. Incase student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics II shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

Laplace Transforms & Vector Space	
Course Code: IS31	**Credits: 2:1:0**
Pre – requisites: Calculus and Basics of Linear Algebra	**Contact Hours: 28L+14Tut**
Course Coordinator: Dr. Govindaraju M V	

Course Content

Unit-1
Laplace Transforms: Definition, transforms of elementary functions, properties of Laplace transforms, existence conditions, transform of derivatives, integrals, multiplication by t n, division by t, evaluation of integrals by Laplace transforms, transform of periodic function.
Unit-2
Application of Laplace Transforms: Unit–step function, unit–impulse function. Inverse transforms, convolution theorem, solution of linear differential equations and simultaneous linear differential equations using Laplace transforms, engineering applications.
Unit-3
Vector space and Linear Transformation: Vector space, linear combination and span, linearly independent and dependent vectors, basis and dimension, linear transformations, matrix of transformations, rotation about the origin, dilation, contraction and reflection, composition of matrix transformations, kernel and range, change of basis.
Unit-4
Orthogonal Projections: The null space of A, solving $Ax = 0$ and $Rx = 0$, the complete solution to $Ax = b$, dimensions of the four subspaces, orthogonality of the four subspaces, projections. orthonormal bases and Gram-Schmidt method, QR-factorization, least-squares approximations.
Unit-5
Applications of Eigenvalue Decomposition: Introduction to eigenvalues and eigenvectors, similarity and diagonalization. symmetric matrices, complex matrices, Hermitian and unitary matrices, positive definite matrices, the singular value decomposition (SVD), principal component analysis (PCA), applications to linear recurrence relations, quadratic forms and conic sections.

Course outcomes

At the end of the course, the student will be able to:

1. Evaluate Laplace Transforms for the given function (PO-1, 2 & PSO-1,2)
2. Compute inverse Laplace transforms to solve system of ODE's (PO-1, 2 & PSO-1,2)
3. calculate matrix of linear transformation. (PO-1, 2 & PSO-1, 3)
4. Solve the system of equations by Least-Squares method. (PO-1, 2 & PSO-1, 3)
5. Compute eigenvalue decomposition of a matrix and use it to study the concepts of SVD and PCA. (PO-1, 2 & PSO-1, 3)

Suggested Learning Resources:

Books

Text Books:

1. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 44 th edition-2017.
2. David C. Lay, Steven R. Lay and Judi J. Mc. Donald – Linear Algebra and its Applications –
3. Pearson – 5 th edition – 2015.
4. Gilbert Strang, Linear Algebra and its Applications, 5 th Edition (2016).

Reference Books:

1. Peter V. O'Neil – Advanced Engineering Mathematics – Cengage learning – 7 th edition – 2011.
2. Gareth Williams – Linear Algebra with Applications, Jones and Bartlett Press – 9 th edition – 2017.
3. Erwin Kreyszig-Advanced Engineering Mathematics-Wiley-India publishers- 10 th edition-2015.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/111/105/111105134/
- https://nptel.ac.in/courses/111/105/111105035/
- https://nptel.ac.in/courses/111/102/111102152/

Digital Systems and Computer Organization	
Course Code: IS32	**Credits: 3:0:1**
Pre – requisites: Introduction to Electronics Engineering	**Contact Hours: 42L+14P**
Course Coordinator: Dr. Anitha P	

Course Content

Unit-1
Introduction to Digital System: Introduction, The Map Method for simplifying Boolean expressions, Two, Three and Four-Variable Map, Don't-Care Conditions, Quine-McCluskey Tabular Method, NAND and NOR Implementation, Exclusive-OR Function, Hardware Description Language – Verilog Model of a simple circuit.
Unit-2
Combinational Logic: Introduction, Design Procedure, Binary Adders, BCD Adder, Decoders, Encoders, Multiplexers and Demultiplexers. HDL Models of Combinational Circuits. **Sequential Logic**: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops. Synchronous and Asynchronous counters. HDL codes for Sequential logic Circuits.
Unit-3
Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Addressing Modes.
Unit-4
Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, **The memory System:** Basic Concepts, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.
Unit-5
Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance.
List of Verilog Programs 1.   Verilog codes for Combinational Logic Circuits 2.   Verilog for Adder and Subtractor 3.   Verilog program for Decimal Adder 4.   Verilog program for Decoders 5.   Verilog program for Encoders 6.   Verilog program for Multiplexers

7.	Verilog program for Demultiplexer.
8.	Verilog program for SR Flip Flop
9.	Verilog program for JK Flip Flop
10.	Verilog program for D flip flop
11.	Verilog program for T flip flop
12.	Verilog program for asynchronous counter

Course outcomes

At the end of the course, the student will be able to:

CO1: Apply the K–Map and Tabulation techniques to simplify various Boolean expressions and realize the same using basic and Universal Gates. (PO1,2,3,5 & PSO2)

CO2: Design different types of combinational, sequential circuits implements the same using verilog codes. (PO1,2,3,4,5,9,10 & PSO2)

CO3: Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO1 & PSO2)

CO4: Understand the approaches involved in achieving communication between processor and I/O devices. (PO1 & PSO2)

CO5: Analyse internal Organization of Memory and Impact of cache/Pipelining on Processor Performance. (PO1,2 & PSO2)

Suggested Learning Resources:

Books

1. M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog Design, 5e, Pearson Education,
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill.

Web links and Video Lectures (e-Resources):

➢ https://nptel.ac.in/courses/106105185
➢ https://nptel.ac.in/courses/106106092
➢ https://a.impartus.com/ilc/#/course/81475/295

Data Structures	
Course Code: IS33	**Credits: 3:0:0**
Pre – requisites: Fundamentals of Computing	**Contact Hours: 42L**
Course Coordinator: Mrs. Kusuma S	

Course Content

Unit-1
Introduction to Data Structures: Definition, Types, Structures, Array of Structures, The Stack: Definition, Representation, Basic operations of stack (PUSH and POP) and its implementation, Applications of stack: Conversion from Infix to Postfix, Evaluation of Postfix expression..

Unit-2
Recursion: definition, processes, and programming examples Queues: Definition, Representation, Primitive operations of queue and its implementation; Circular queues and Priority queues, Graphs in data structures

Unit-3
Linked List: Memory allocation functions; Representation and implementation of operations (Insertion, Deletion and Search) of Singly, Doubly and Circular Linked Lists, Implementation of stack and queue using lists, Comparing the dynamic and array implementation of lists.

Unit-4
Trees: Binary Trees, Binary Tree Representations, Representing Lists as Binary trees, Trees and their applications; Binary Search Tree, Tree traversals.

Unit-5
B-Tree: Searching, Insertion and Deletion Hashing: Hash Function, Collision, Probability of Collision, Collision handling techniques, Progressive Overflow, Buckets, Chained Progressive Overflow.

Course outcomes

At the end of the course, the student will be able to:

1. Apply array/structure/stack data structure for a given problem statement (PO1, PO2, PO3, PO9, PO10, PO12 & PSO-1)

2. Implement various operations of queue to find a solution to the problem (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)

3. Implement various types of linked lists and their operations using dynamic memory allocation. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)

4. Construct Binary Trees and perform various types of Tree Traversals. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)

5. Apply B-Trees and hashing techniques to solve a given problem. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)

Suggested Learning Resources:

Books

1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C", 2nd Edition, PHI, 2009.

2. Michael J. Folk, Bill Zoellick and Greg Riccardi, "File Structures-An Object Oriented Approach with C++", Pearson Education, 2004

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106102064
- https://nptel.ac.in/courses/106106133

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- coding Demo

Operating Systems	
Course Code: IS34	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Mr. Jagadeesh Sai D	

Course Content

Unit-1
Operating Systems Overview: Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security. Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, Process Scheduling: Basic Concepts, Scheduling Criteria -Scheduling Algorithms
Unit-2
Synchronization: Background, The Critical-Section Problem and its solutions, Synchronization Scheduling Algorithms, Semaphores Classic Problems of Synchronization, Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock.
Unit-3
Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual-Memory Management: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames
Unit-4
File System: File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing, Implementing File Systems: File, System Structure, File-System Implementation, Allocation Methods, Free space Management.
Unit-5
Mass Storage Structure: Overview, Disk Structure, Disk Attachment, Disk Scheduling. System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control.
Course outcomes
At the end of the course, the student will be able to:

1. Understand the structure and functionality of the operating system and apply CPU scheduling algorithms for the given problem. (PO1, PO2, PO3, PO9, PO10, PO12, PSO2)

2. Analyse the various algorithms for process synchronization and deadlock handling. (PO1, PO2, PO9, PO10, PO12, PSO2)
3. Apply the various techniques for memory management. (PO1, PO2, PO3, PO9, PO10, PO12, PSO2)
4. Understand file and secondary storage management strategies. (PO1, PO2, PO9, PO10, PO12, PSO2)
5. Describe the need for information protection mechanisms and the working of modern operating system (PO1, PSO2)

Suggested Learning Resources:

Books

Abraham Silberschatz, Peter B Galvin, Gerg Gagne, Operating Systems Concepts, 9th Edition, 2016 India Edition, Wiley Publications. Reference Books:

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106133
- https://nptel.ac.in/courses/106105214

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Problem Solving

Discrete Mathematical Structures	
Course Code: IS35	**Credits: 2:1:0**
Pre – requisites: Nil	**Contact Hours: 28L + 14T**
Course Coordinator: Mrs. Prathima M. N.	

Course Content

Unit-1
Fundamentals: Sets and subsets, operations on sets, Sequences. Logic: Propositions and Logical Operations, Conditional statement, Methods of proofs.

Unit-2
Relations and Digraphs: Product sets and partitions, relations and digraphs, paths in relations and digraphs, properties of relations, equivalence relations, operations on relations, transitive closure and Warshall's algorithm.

Unit-3
Functions: Functions for computer science, Permutation functions, POSETS: order relations and structures: extremal elements of partially ordered sets, lattices.

Unit-4
Graphs: Graphs, graph terminology and special types of graphs, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths.

Unit-5
Groups: Semi-groups Binary operations revisited: Tables, semigroups: subsemigroup, submonoid, isomorphism, homomorphism, group.

Tutorial Sessions:
1. Problems solving based on sets, operation on sets.
2. Representation of different formulae in Sequence and identifying regular expressions.
3. Performing different operations using Logical operators and verifying different statements using Mathematical induction.
4. Problems on counting techniques.
5. Working out problems in Relations and digraph.
6. Problems related to operations on relations, transitive closure and Warshall's algorithm.
7. Identify types of Functions, Functions for Computer Science.
8. Usage of Partially ordered relations and structures in terms of Hasse diagram and Topological Sorting.
9. Identify Hasse diagram represent lattices and Usage of types of lattices.

10. Terminologies in graphs and their models.
11. Problems related to Euler, Hamilton paths/circuits, semigroups.
12. Verifying different properties representing Group.
13. Problems on other mathematical structures.
14. Identifying noise in coding of binary information and detection of errors.

Course outcomes

At the end of the course, the student will be able to:

1. Apply the concepts of set theory and logical reasoning to verify the correctness of mathematical statements (PO-1,2,9,10,12 & PSO-1)
2. Analyze the properties and operations of relations in solving various problems. (PO-1,2,9,10,12 & PSO-1)
3. Understanding the concepts of functions and partially ordered sets for solving the given problem. (PO-1,2,9,10,12 & PSO-1)
4. Apply the graph theory concepts in solving computational problems. (PO-1,2,9,10,12 & PSO-1)
5. Apply the concepts of groups for binary operations. (PO-1,2,9,10,12 & PSO-1)

Suggested Learning Resources:

Books

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Discrete Mathematical Structures, 6th edition, PHI

2. Kenneth H Rosen, Discrete Mathematics and its applications, 6th Edition, Tata McGraw-Hill.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106094
- https://nptel.ac.in/courses/106108227

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Problem Solving

Data Structures Lab	
Data Structures Lab	
Course Code: ISL36	Credits: 0:0:1
Pre – requisites: Fundamentals of Computing	Contact Hours: 14P
Course Coordinator: Mr. Shivananda S	

Sl.NO	List of Experiments
1	Student Program using Structures.
2	Program using pointers to allocate and deallocate memory space.
3	Write a program to illustrate forward and backward surfing in the web browser using stack (Array implementation). Display the appropriate messages in case of exceptions.
4	Write a program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and binary operators + - * /. Apply the concept of stack data structure to solve this problem.
5	Write a program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary operators. The operators are + - * and /.
6	A call center phone system has to hold the phone calls from customers and provide service based on the arrival time of the calls. Write a C program to simulate this system using queue data structure. Program should have options to add and remove the phone calls in appropriate order for their service.
7	Write a program to demonstrate round robin processor scheduling using circular queue (array implementation) with suitable inputs. Program should have options to add, remove and display elements of the queue.
8	Write a program to illustrate memory allocation to files based on their size using singly linked list. Program must support the following operations on a singly linked list. a. Inserting a node b. Deleting a node c. Display
9	Write a program to illustrate memory allocation to files based on their size using doubly linked list. Program must support the following operations on a doubly linked list. a. Inserting a node b. Deleting a node c. Display
10	Write a program to illustrate forward and backward surfing in the web browser using stack (Linked List implementation). Display the appropriate messages in case of exceptions.

11	Write a program to implement Queue Data Structure (Linked List implementation). Display the appropriate messages in case of exceptions.
12	A hospital database consists of CT images of patients. The physician wants to query the image database and retrieve most similar images. In order to support this facility implement database indexing using binary search tree and preoder traversal method.

Course outcomes:

At the end of the course the student will be able to:

1. Design the experiment for the given problem using Data Structures concepts. (PO1, PO2, PO3, PO9, PO10, PSO1)

2. Develop the solution for the given real world problem. (PO1, PO2, PO3, PO4, PO9, PO10, PSO1)

3. Analyze the results and produce substantial written documentation (PO1, PO2, PO4, PO9, PO10, PSO1)

	Unix System Programming Lab
Course Code: ISL37	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Dr. Yogish H K	

Sl.NO	List of Experiments
1	Shell Programs using various conditional control constructs
2	Shell Programs using various Loops constructs
3	Shell Programs using Arrays
4	Shell Programs using Functions
5	Write a C/C++ POSIX compliant program to check the various limits during run time.
6	Write a C++ program that prints the POSIX defined configuration options supported on any given system using Feature Test Macros and POSIX version.
7	Write a C/C++ POSIX compliant program to check the various limits during run time.
8	Write a C/C++ program to implement UNIX commands ln, mv, rm commands using APIs.
9	Write a program in C/C++ to display the contents of named file on standard output device., Also Write a program to copy the contents of one file to another.
10	Write C/C++ program to list the named directory contents.
11	Write a program to demonstrate process is Zombie, Daemon Process and avoid Zombie process.
12	Write a Program to demonstrate race condition and avoid race condition.
13	Write a program to implement UNIX system (), using APIs.
14	Write a program to create, writes to, and reads from a pipe. Also Write a program to create a pipe from the parent to child and send data down the pipe.

Course outcomes:

At the end of the course the student will be able to:

CO1 Apply unix commands for implementing shell programs.

CO2: Design the solutions for a given problem using the concepts of shell scripts

CO3: Identify processes related activities and inbuilt file APIs thus apply the same to solve the problem

Universal Human Value	
Course Code: UHV38	**Credits: 2:0:0**
Pre – requisites: Nil	**Contact Hours: 28L**
Course Coordinator: Mr. Mushtaq Ahmed D M	

Course Content

Unit-1
Introduction - Need, Basic Guidelines, Content and Process for Value Education : ● Understanding the need, basic guidelines, content and process for Value Education ● Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration ● Continuous Happiness and Prosperity- A look at basic Human Aspirations ● Right understanding, Relationship and Physical Facilities- 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
Unit-2
Understanding Harmony in the Human Being - Harmony in Myself! ● Understanding human being as a co-existence of the sentient 'I' and the material 'Body' ● Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha ● Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) ● Understanding the characteristics and activities of 'I' and harmony in 'I'

- Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Swasthya
- Practice Exercises and Case Studies will be taken up in Practice Sessions

Unit-3

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding Harmony in the family – the basic unit of human interaction
- Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
- Understanding the meaning of Vishwas; Difference between intention and competence
- Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family):Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!
- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Unit-4

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

- 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 (Sah-astitva) of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence
- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Unit-5

Implications of the above Holistic Understanding of Harmony on Professional Ethics :
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
- At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- At the level of society: as mutually enriching institutions and organizations

Course outcomes

CO 1   Apprehend the need of Value Education over Human aspirations   PO-6

CO 2   Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life.   PO-6

CO 3   Recognize the need of Harmony in the Family and Society for a better World.   PO-6

CO 4   Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence.   PO-6

CO 5   Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society.   PO-6,8

Suggested Learning Resources:

Book

Text Books:

R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books:

1. **B L Bajpai**, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. **PL Dhar, RR Gaur**, 1990, *Science and Humanism*, Commonwealth Publishers.
3. **Sussan George**, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
4. **Ivan Illich**, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
5. **Donella H. Meadows, Dennis L. Meadows, Jorgen Randers**, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. **Subhas Palekar**, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. **A Nagraj**, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
8. **E.F. Schumacher**, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. **A.N. Tripathy**, 2003, *Human Values*, New Age International Publishers.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

3. **Course handouts:**
   https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:** https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing

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Green IT and Sustainability	
Course Code: ISAEC391	**Credits: 1:0:0**
Pre – requisites: nil	**Contact Hours: 14L**
Course Coordinator: Dr. Vijaya Kumar Beekanahalli	

Course Content

Unit-1
Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.
Unit-2
Emerging Technologies and Their Environmental Impact: Introduction, Number of Connected Devices , Increased , Functionality, Increased Number of Separate Functions , Increased Demand for Speed and Reliability , Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT Resources
Unit-3
Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures
Unit-4
Sustainable Cloud Computing: Introduction, Challenges in the Use of Cloud Computing As Green Technology ,Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing ,Reflections on Sustainable Cloud Computing Applications
Unit-5
Sustainable Software Design: Overview and Scope, Evaluating Sustainability Effects , Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime

Energy Consumption Basics , Analyzing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches

Course outcomes

At the end of the course, students will be able to

1. Analyse the challenges for Green ICT (PO-1,2,7, 9,10,12 & PSO-2)
2. Understand the environmental impact due to emerging technologies (PO-1,7, 9,10,12 & PSO-2)
3. Understand different aspects of ICT metrics (PO-1,7, 9,10,12 & PSO-2)
4. Analyse the various parameters related to Sustainable Cloud Computing (PO-1,2,7, 9,10,12 & PSO-2)
5. Analyse the effects of software design on the sustainability (PO-1,2,7, 9,10,12 & PSO-2)

Suggested Learning Resources:

Books

Text Books:

Green Information Technology – A Sustainable Approach, Mohammad Dastbaz Colin Pattinson, Babak Akhgar, Elsevier, 2015 Inc.

References:

 San   Murugesan; G.R.   Gangadharan, Harnessing   Green IT: Principles   and Practices, Wiley-IEEE Press

Web links and Video Lectures (e-Resources):

● https://www.youtube.com/watch?v=kvn_-mJ2tSo

● https://www.youtube.com/watch?v=kxngsYn5N3Y
● https://www.youtube.com/watch?v=EgdFi3sCgzU
● https://www.brightest.io/sustainability-measurement
● https://www.youtube.com/watch?v=S2m49Op25Zw

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

● Literature Review

Capacity planning for IT	
Course Code: ISAEC392	**Credits: 1:0:0**
Pre – requisites:	**Contact Hours: 14L**
Course Coordinator: Dr. Krishna Raj**P M**	

Course Content

Unit-1
Goals, Issues, and Processes: capacity planning, Quick and Dirty Math, Predicting When Your Systems Will Fail , Make Your System Stats Tell Stories, Buying Stuff: Procurement Is a Process, Performance and Capacity: Two Different Animals, The Effects of Social Websites and Open APIs **Setting Goals for Capacity:** Different Kinds of Requirements and Measurements, Architecture Decisions
Unit-2
Measurement: Units of Capacity: Aspects of Capacity Tracking Tools, Applications of Monitoring
Unit-3
Measurement: API Usage and Its Effect on Capacity, Examples and Reality, **Predicting Trends:** Riding Your Waves
Unit-4
Predicting Trends: Procurem`ent, The Effects of Increasing Capacity , Long-Term Trends, Iteration and Calibration **Deployment:** Automated Deployment Philosophies, Automated Installation Tools , Automated Configuration
Unit-5

Virtualization and Cloud Computing: Virtualization, Cloud Computing, Computing Resource Evolutions, Mixed Definitions, Cloud Capacity, Use it or lose it (your wallet),Measuring the clouds,

Cloud Case Studies,Cloud Use Case: Anonymous Desktop Software Company

Course outcomes

At the end of the course, the student will be able to:

1. Analyze the requirement and measurements for capacity planning by considering the goal, issues, and processes (PO-1,2 ,7,9,10,11,12 & PSO-2)

2. describe capacity measurement and monitoring (PO-1,2,7,9,10,11,12 & PSO-2)

3. Analysis the measurement data for prediction towards overall planning process. (PO-1,2,5,7,9,10,11,12 & PSO-2)

4. understand the concepts related to deployment, installation, configuration, and management. (PO-1,2,5,7,9,10,11,12 & PSO-2)

5. Evaluate how the virtualization and cloud services fit into a capacity plan. (PO-1,2,7,9,10,11,12 & PSO-2)

Suggested Learning Resources:

Text Books:

John Allspaw, The Art of Capacity Planning, 2008, O'Reilly

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=w0cD26CLBA0
- https://www.youtube.com/watch?v=5-hhfBXykec
- https://www.youtube.com/watch?v=9e4IohiFmZ8&t=63s
- https://www.youtube.com/watch?v=qj4ziswxupE
- https://www.youtube.com/watch?v=jTW79ofC6Go
- https://www.youtube.com/watch?v=_pPlanX5wQY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Tool demonstration

Numerical Analysis with Python	
Course Code: ISAEC393	Credits: 1:0:0
Pre – requisites:	Contact Hours: 14L
Course Coordinator: Kavya K S	

Course Content

Unit-1
Introduction to Python: Overview of Python, basic syntax, Variables, data types, and operators, Control structures (if statements, loops) and functions Numerical Computing with NumPy: Introduction to NumPy, arrays, and array operations
Unit-2
Numerical Computing with NumPy: NumPy indexing and slicing, broadcasting, NumPy functions for numerical computations Pandas in python: Data Structures in Pandas, DataFrame: Introduction to one-dimensional and two-dimensional data structures.
Unit-3
Indexing and Slicing: Setting and resetting indexes, Selecting data by label and by position, Slicing and filtering data. Data Manipulation: Sorting data., Aggregating data (e.g., mean, sum, count), Grouping and applying functions, Adding, updating, and deleting columns.
Unit-4
Data preprocessing techniques: Introduction to Data Preprocessing, Importance of data preprocessing. Overview of data preprocessing steps, Python tools and libraries for data preprocessing (e.g., Pandas, NumPy).

Data Cleaning: Handling missing data (NaN values), Removing duplicates, Data type conversions.
Unit-5
Data Transformation, Data scaling and normalization, removing duplicates, detecting and filtering outliers. Data Visualization with Matplotlib: Introduction to Matplotlib, creating basic plots Customizing plots, adding labels, legends, and annotations Advanced plotting techniques and 3D plotting

Course outcomes

At the end of the course, the student will be able to:

CO1: Apply programming constructs of Python to solve a given problem (PO - 1, 2, 3, 4, 5 & PSO - 3)

CO2: Apply Numpy functionalities to solve numerical problems (PO - 1, 2, 3, 4, 5 & PSO - 3)

CO3: Apply Panda library constructs for data analytics (PO - 1, 2, 3, 4, 5 & PSO - 3)

CO4: Apply tools and techniques of python for data preprocessing (PO - 1, 2, 3, 4, 5 & PSO - 3)

CO5: Apply mathplotlib for data visualisation (PO - 1, 2, 3, 4, 5 & PSO - 3)

Suggested Learning Resources:

Books

Textbooks:

1. "Python for Data Analysis" - O'Reilly, Wes McKinney, 2013
2. Automate the boring stuff with python: Practical programming for total beginners, Al Sweigart, 2015

Web links and Video Lectures (e-Resources):

● 	https://nptel.ac.in/courses/106106212

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

● 	Programming Assignment

Statistics, Probability and Linear Programming	
Course Code: IS41	Credits: 2:1:0
Pre – requisites: Basic Probability	Contact Hours: 28L + 14Tut
Course Coordinator: Dr. Govindaraju M V	

Course Content

Unit-1
Statistics: Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves, correlation, regression and multiple regression. Probability Distributions: Random variables, Binomial distribution, Poisson distribution.

Unit-2
Probability Distributions: Uniform distribution, Exponential distribution, Gamma distribution and Normal distribution. Joint probability distribution: Joint probability distribution (both discrete and continuous), conditional probability, conditional expectation.

Unit-3
Markov Chain: Introduction to stochastic process, probability vectors, stochastic matrices, regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states, Markov and Poisson processes. Queuing theory: Introduction, symbolic representation of a queuing model, single server Poisson queuing model with infinite capacity (M/M/1 : /FIFO), single server Poisson queuing model with finite capacity (M/M/S : N/FIFO), multiple server Poisson queuing model with infinite capacity (M/M/S : /FIFO), Multiple server Poisson queuing model with finite capacity (M/M/S : N/FIFO), introduction to M/G/1 queuing model.

Unit-4
Sampling and Statistical Inference: Sampling distributions, central limit theorem, concepts of standard error and confidence interval, level of significance, type I and type II errors, one tailed and two tailed tests, Z-test: for single mean, for single proportion and for difference between means, Student's t –test: for single mean and for difference between two means, F – test for

equality of two variances, Chi-square test: for goodness of fit and for independence of attributes.

Unit-5

Linear Programming: Introduction to linear programming problem (LPP), formulation of the problem, graphical method, general, canonical and standard forms of LPP, simplex method, big-M method, two-phase simplex method and duality in linear programming.

Course outcomes

At the end of the course, students will be able to

1. Fit a least squares curve to the given data and analyze the given random data and its

probability distributions. (PO-1, 2 & PSO-2, 3)

2. Find parameters of Continuous Probability distributions and calculate the marginal and

conditional distributions of bivariate random variables. (PO-1, 2 & PSO-2, 3)

3. Predict future events using Markov chain and in queuing models. (PO-1, 2 & PSO-2, 3)

4. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1, 2 & PSO-2, 3)

5. Formulate and solve a simple linear programming problem. (PO-1, 2 & PSO-1, 3)

Suggested Learning Resources:

Books

Text Books:

1. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9 th edition – 2012.

2. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 44 th edition-2017.

3. T. Veerarajan- Probability, Statistics and Random processes – Tata McGraw-Hill Education – 3 rd edition -2017.

4. Kanti Swarup, P.K. Gupta and Man Mohan -Operations Research-Sultan Chand & Sons

Publishers–2014.

Reference Books:

1. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers- 10 th edition-2015.

2. Sheldon M. Ross – Probability models for Computer Science – Academic Press, Elsevier– 2009.

3. Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's

outlines -4 nd edition-2012.

4. Kishore S. Trivedi – Probability & Statistics with Reliability, Queuing and Computer ScienceApplications – John Wiley & Sons – 2 nd edition – 2008.

5. Johnson/Miller: Miller &Freund Probability and Statistics for Engineers , Eighth Edition, PearsonEducation India -2015

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/111/105/111105035/
- https://nptel.ac.in/courses/111/107/111107119/
- https://nptel.ac.in/courses/111103022
- https://nptel.ac.in/courses/111104027

Microcontrollers	
Course Code: IS42	**Credits: 3:0:1**
Pre – requisites: Computer Organization and Architecture	**Contact Hours: 42L + 14P**
Course Coordinator: Mr. Prashanth Kambli	

Course Content

Unit-1
ARM Embedded Systems, RISC design philosophy, ARM design philosophy, Introduction to Embedded systems, Design of Embedded Systems, Applications, Embedded processors, Operating System, Connectivity. Internal Components of System-on-chip, General Microprocessor unit, MCU PIN diagram, Timers and Counters, Pulse width modulator.
Unit-2
Serial Communication, Direct Memory Access, Semiconductor Memory, Designing Low power systems, BUS architecture. Embedded Systems – the Software, Endian-ness, Data Alignment and Memory Banks, Peripheral I/O and Memory Mapped I/O, Load Store Architecture, Stack, FLAGS
Unit-3
The Architecture of ARM 7, ARM 7 architecture, Interrupts and Exceptions, ARM7 pipeline, Advanced Features. Assembly Programming of ARM7, Embedded program development, ARM7 Instruction set.
Unit-4
Assembly Language Programming, Accessing Memory, Programming of ARM7 using C, ARM7 SOC.
Unit-5
Architecture of ARM Cortex-M, Cortex-M Processors, Cortex-M0, Modes and States, Programming Model, Memory Model, Nested Vector Interrupt Controller, Power management using sleep modes.
MICROCONTROLLER LAB **Part A** 1. a. ALP to add first 10 odd numbers. Store sum in register. b. ALP to compute sum of squares of 5 numbers starting from 1. Write and use procedure SQU. Store sum in register.

2. a. ALP to add the first n even numbers. Store the result in a memory location. b. ALP to generate a geometric progression with a limit n. Display the results in memory.

3. a. ALP to count the number of zeroes and ones in a binary number. b. ALP to find the average of ten 16-bit numbers stored in memory.

4. a. ALP to find the factorial of a number. b. ALP to generate the first n Fibonacci numbers.

5. ALP to find the sum of digits of a number.

6. ALP to convert BCD number to binary.

7. ALP to select a set of r objects from a set of n objects without considering the order of elements in a selection using combination method.

8. ALP to select a set of r objects from a set of n objects considering the order of elements in an arrangement using permutation method.

9. ALP to implement Bubble Sort on an array of integers.

10. ALP to implement Binary Search on an array of integers.

11. ALP to check whether the given number is palindrome.

12. ALP to count the number of times a substring is repeated in the string.

Part B

1. C program to toggle the lowest pin of Port 0 with a delay between the two states. Observe and record the waveform obtained using the Logic Analyzer in the Keil simulator.

2. C program to generate an asymmetric square wave of 120Hz and having a duty cycle of 25% using the Timer0 module.

3. C program to generate a square wave using Timer0 in the interrupt mode.

4. C program to make a LED glow at different brightness levels (low to high) with brightness levels varying over duration of 2s. Demonstrate using logic analyzer window.

5. C program to display the string 'I LOVE ISE' in the serial window of UART1

6. Write a C program to Interface NuMicro MCU Learning Board to Light a RGB LED connected to port A12-14.

7. Write a C program to Interface NuMicro MCU Learning Board to beep a buzzer connected to port B11.

8. Write a C program to Interface NuMicro MCU Learning Board to a even segment to display the values from 0 to 9999.

9. Write a C program to Interface NuMicro MCU Learning Board to a 3x3 keypad and output the string "Hello world" to LCD display.

Course outcomes

At the end of the course, the student will be able to:

1. Understand the basics of embedded processors and operating system for different application scenarios (PO1, PSO2)

2. Describe the building blocks that contribute to the software aspects of embedded system design. (PO1, PO2, PO3, PSO1, PSO2)

3. Design ARM7 programs that includes interrupt structure and pipeline. (PO1, PO2, PO3, PSO1, PSO2)

4. Develop ARM7 assembly code for a given problem (PO1, PO2, PO3, PSO1, PSO2)

5. Compare Cortex-M processors in terms of architecture, memory model and interrupt structure (PO1, PSO-2)

Suggested Learning Resources:

Books

1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide - Designing and Optimizing System Software", Elsevier Publication 2012.

2. Lyla B Das, "Architecture, Programming, and Interfacing of Low-power Processors – ARM7, Cortex-M", Cengage Learning India Pvt. Ltd. 2017.

Web links and Video Lectures (e-Resources):

● https://nptel.ac.in/courses/117104072

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

● Programming Assignment

Design and Analysis of Algorithms	
Course Code: IS43	**Credits: 3:0:0**
Pre – requisites: Fundamentals of Computing & Data Structures	**Contact Hours: 42L**
Course Coordinator: Dr. Sumana M	

Course Content

Unit-1
Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types. Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical analysis of Non-Recursive and Recursive algorithms
Unit-2
Brute Force: Selection Sort and Bubble Sort, Divide and Conquer: Merge Sort, Quick Sort, Analysis of Binary Search and Binary Tree Traversal Algorithms. Space and Time Trade-offs: Horspool's Algorithm.
Unit-3
Dynamic Programming: Warshall's and Floyd's Algorithms, The Knapsack Problem. Greedy Technique: Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.
Unit-4
Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Transform and Conquer: Balanced Search Trees - AVL Tree, 2 - 3 Tree
Unit-5
Heaps and Heapsort, Limitations of Algorithm Power: P, NP and NP-Complete Problems. Coping with the Limitations of Algorithm Power: Backtracking (n-Queens Problem) Branch-andBound (Travelling Salesman Problem)

Course outcomes

At the end of the course, the student will be able to:

1. Describe the fundamentals of algorithms, problem types and standard algorithm design techniques. (PO1, PSO1)

2. Apply divide and conquer design techniques to solve computational problems. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)

3. Apply dynamic programming or greedy techniques to solve the given problem. (PO1, PO2, PO4, PO9, PO10, PO12, PSO1)

4. Apply suitable design techniques to solve graphs and trees based problems. (PO1, PO2, PO3, PO4, PO9, PO10, PO12, PSO1)

5. Understand the limitations of algorithms in solving computational problems. (PO1, PSO1)

Suggested Learning Resources:

Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Introduction to Algorithms, 2nd Edition, PHI, 2006.

2. Computer Algorithms, Horowitz E. Sahni S, Rajasekaran S, Galgotia Publications, 2001.

Web links and Video Lectures (e-Resources):

● https://nptel.ac.in/courses/106101060
● https://nptel.ac.in/courses/106101059

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

● Programming Assignments

Database Management Systems	
Course Code: IS44	Credits: 3:0:0
Pre – requisites:	Contact Hours: 42L
Course Coordinator: Mrs. Savita K Shetty	

Course Content

Unit-1

Introduction to DBMS. Three-schema architecture and data independence; Database languages and interfaces; Classification of Database Management systems. Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types.

Unit-2

Refining the ER Design; ER Diagrams, Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations, Relational Database Design Using ER- to-Relational Mapping. Informal Design Guidelines for Relation Schemas; Functional Dependencies.

Unit-3

Normal Forms Based on Primary Keys-1NF, 2NF, 3NF, BCNF. Codd rules SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL;

Unit-4

Complex SQL Queries. Insert, Delete and Update statements in SQL. Introduction to Transaction Processing, Transaction and System Concepts, Desirable properties of Transactions, Transaction Support in SQL.

Unit-5

Two-phase Locking Techniques for Concurrency Control, Recovery techniques based on Deferred Update, Recovery techniques based on Immediate Update. Introduction to NoSQL, characteristic and types of NoSQL database

Course outcomes

At the end of the course, the student will be able to:

1. Design Entity Relationship model for the given database problem. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1, PSO3)

2. Develop relational model from the given Entity Relationship diagram. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1, PSO3)

3. Design the relational database schema by applying normalization techniques. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1, PSO3)

4. Apply query language to perform database operations. (PO1, PO2, PO3, PO5, PO9, PO10, PO12, PSO1, PSO3)

5. Understand the concepts of transaction processing, concurrency control and recovery techniques. (PO1, PO12, PSO1, PSO3)

Suggested Learning Resources:

Books

1. Ramez Elmasri and Shamkant B.Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007.

2. Benjamin Rosenzweig, Elena Silvestrova Rakhimov: Oracle PL/SQL by Example, 4th Edition, 2010.

Web links and Video Lectures (e-Resources):

● https://nptel.ac.in/courses/106105175

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

● Mini - project

Advanced Java	
Course Code: IS45	**Credits: 3:0:0**
Pre – requisites:	**Contact Hours: 42L**
Course Coordinator: Mrs. Evangeline D	

Course Content

Unit-1
Handling Characters and Strings: The string Class and Its Methods, Mutable Strings with StringBuilder and StrinfBuffer, Converting Primitives to Strings   **Generics<T>:** Introduction to Java Generics, Implementing Generics
Unit-2
Special Types of Java SE: Object, java.util.Object, Comparing Objects, Wrapper Classes and Autoboxing, Iterator and Iterable   **Lambda Expressions and Functional Programming:** Functional Interfaces and Lambda Expressions, Method References, Functional Programming, Functional Interfaces from the java.util.function Package
Unit-3
Concurrent Programming: Concurrency and Parallelism, Generating Existing Threads and New Threads, Thread Members and States, Executor Interface and Thread Pools   **Introduction to Data Structures and Algorithms:** Lists and Sets
Unit-4
Java Servlets – Introduction, Servlet API and Life Cycle, Working with Servlets
Unit-5
Working with Databases – JDBC Drivers and Architecture, Accessing Databases, The Customers GUI Example   Java Server Pages – Introduction to JSP, Getting started with JSP

Course outcomes

At the end of the course, the student will be able to:

CO1: Write applications using java generics (PO - 1, 2, 3, 4, 5) & PSO - 3)

CO2: Implement applications using functional style programming   (PO 1, 2, 3, 4, 5- & PSO - 3)

CO3: Use collection classes and multithreading in programs (PO1, 2, 3, 4, 5 - & PSO - 3)

CO4: Develop JavaEE application using Servlets (PO -1, 2, 3, 4, 5, 9, 10 & PSO - 3)

CO5: Develop Web Application using JDBC and JSP (PO 1, 2, 3, 4, 5, 9, 10 & PSO - 3)

Suggested Learning Resources:

Books

1.   Christian Ullenboom, Java: The Comprehensive Guide, Shroff Publishers, October, 2022

2.   Sharanam Shah, Vaishali Shah, JavaEE 7 for Beginners, Shroff Publishers, 2018

Web links and Video Lectures (e-Resources):

●   https://nptel.ac.in/courses/106105191

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

●   mini - project

	Design and Analysis of Algorithms Lab	
Course Code: ISL46		**Credits: 0:0:1**
Pre – requisites:		**Contact Hours: 14P**
Course Coordinator: Mrs. J R Shruti		

Sl.NO	List of Experiments
1	The goods packages in a supermarket are assigned an integer label. Write a C program to sort the set of goods packages based on label identifier using Bubble Sort/Selection Sort and determine the time required to sort. Plot a graph of number of label identifiers versus time taken.
2	A library maintains details of N books where every book is assigned a unique ISBN. Develop a program in C to sort the books based on ISBN using merge sort technique. Determine the time required to sort. Repeat the experiment for different values of N and plot a graph of the time taken versus N
3	Consider a list of 'n' files numbered using ID's. Write a C program to sort files based on its ID using Quick sort. Determine the time required to sort the files. Plot a graph of number of IDs versus time taken.
4	Consider a network of 'n' systems represented as a Graph. Write a 'C' program to find the transitive closure of such a network using Warshall's algorithm. Give the trace of this algorithm.
5	Suppose in a network of cities, you are interested in finding shortest paths between all cities. Design a 'C' program to implement this using Floyd's algorithm. Give the trace of this algorithm.
6	Design and develop a program in C to print all the nodes reachable from a given starting node in a digraph by using BFS method. Give the trace of this algorithm
7	A university is looking for engineering graduates, they need to sort the candidate's resume based on their ranking. Write a C program to sort the resumes by using heap sort. Determine the time required to sort the elements. Plot a graph of the number of elements versus time taken. Specify the time efficiency class of this algorithm.
8	Consider the problem of searching for genes in DNA sequences. A DNA sequence is represented by a text using alphabets [A, C, G, T]. Design a 'C' program to locate a pattern in a given DNA sequence using Horspool's algorithm. Give the trace of this algorithm
9	Consider an electrical layout where 'n' houses are connected by electrical wires. Design a 'C' program using Kruskal's Algorithm to output a connection with minimum cost. Find its time and space complexity.

10	Given 'N' items with their weight and value. Also, a bag is given whose capacity is 'W'. Write a C program based on dynamic programming design technique to find the subset of items that fit into the bag and earn maximum profit. Give the trace of this algorithm.
11	Given a weighted connected graph of N cities, Write a C program to find shortest paths from a given city to all other cities using Dijkstra's algorithm. Give the trace of this algorithm
12	A hostel building is designed with NxN rooms and there are N students for whom the room is to be allotted. Design a C program to allot the students to these rooms using N-queen's method such that no two students are allotted rooms in the same row, column or diagonal. Give the trace of this algorithm.

Course outcomes:

At the end of the course the student will be able to:

1. Design the experiment for the given problem using various standard algorithmic techniques. (PO1, PO2, PO3, PO9, PO10, PSO-1)

2. Develop the solution for the given real world problem. (PO1, PO2, PO3, PO4, PO9, PO10, PSO1)

3. Analyze the results and produce substantial written documentation (PO1, PO2, PO4, PO9, PO10, PSO1)

Database Management Systems Lab	
Course Code: ISL47	**Credits: 0:0:1**
Pre – requisites:	**Contact Hours: 14P**
Course Coordinator: Mrs. Kusuma S	

Sl.NO	List of Experiments
1	Consider an Employee with a social security number (SSN) working on multiple projects with definite hours for each. Each Employee belongs to a Department. Each project is associated with some domain areas such as Database, Cloud and so on. Each Employee will be assigned to some project. Assume the attributes for Employee and Project relations.
	a) Mention the constraints neatly.
	b) Design the ER diagram for the problem statement
	c) State the schema diagram for the ER diagram.
	d) Create the tables, insert suitable tuples and perform the following operations in SQL
	1. Obtain the details of employees assigned to "Database" project.
	2. Find the number of employees working in each department with department details.
	3. Update the Project details of Employee bearing SSN = #SSN to ProjectNo = #Project_No and display the same.
	e) Create the table, insert suitable tuples and perform the following operations using MongoDB
	1. List all the employees of Department named #Dept_name.
	2. Name the employees working on Project Number :#Project_No
	f) Write a program that gives all employees in Department #number a 15% pay increase. Display a message displaying how many employees were awarded the increase.
2	Consider the relations: PART, SUPPLIER and SUPPLY. The Supplier relation holds information about suppliers. The attributes SID, SNAME, SADDR describes the supplier. The Part relation holds the attributes such as PID, PNAME and PCOLOR. The Shipment relation holds information about shipments that include SID and PID attributes identifying the supplier of the shipment and the part shipped, respectively. The Shipment relation should contain information on the number of parts shipped.
	a) Mention the constraints neatly.

		b) Design the ER diagram for the problem statement

b) Design the ER diagram for the problem statement

c) State the schema diagram for the ER diagram.

d) Create the above tables, insert suitable tuples and perform the following operations in Oracle SQL:

1. Obtain the details of parts supplied by supplier #SNAME.

2. Obtain the Names of suppliers who supply #PNAME.

3. Delete the parts which are in #PCOLOR.

e) Create the table, insert suitable tuples and perform the following operations using MongoDB

1. Update the details of parts for a given part identifier: #PID.

2. Display all suppliers who supply the part with part identifier: #PID.

f) Write a PL/SQL program to copy the contents of the Shipment table to another table for maintaining records for specific part number.

3	Consider the relations BOAT, SAILOR and RESERVES. The relation BOAT identifies the features of a boat such as unique identifier, color and a name. The list of sailors with attributes such as SailorID, name, age etc., are stored in the relation SAILOR. The sailors are allowed to reserve any number of boats on any day of the week and the records are to be updated in the RESERVES table.

a) Mention the constraints neatly.

b) Design the ER diagram for the problem statement

c) State the schema diagram for the ER diagram.

d) Create the tables, insert suitable tuples and perform the following operations in SQL:

1. Obtain the details of the boats reserved by '#Sailor_Name'.

2. Retrieve the BID of the boats reserved necessarily by all the sailors.

3. Find the number of boats reserved by each sailor. Display the Sailor_Name along with the number of boats reserved.

e) Create the table, insert suitable tuples and perform the following operations using MongoDB.

1. Obtain the number of boats obtained by sailor :#Sailor_Name

2. Retrieve boats of color :"#color"

f) Write a PL/SQL program to check whether a given number is prime or not. |

4	Consider the Banking database – CUSTOMER, BRANCH, ACCOUNT and TRANSACTION. An account can be a savings account or a current account. Customer can have both types of accounts. The transactions can be a deposit or a withdrawal. Mention the constraints neatly. a) Design the ER diagram for the problem statement b) State the schema diagram for the ER diagram. c) Create the above tables, insert suitable tuples and perform the following operations in SQL: 1. Obtain the details of customers who have both Savings and Current Account. 2. Retrieve the details of branches and the number of accounts in each branch. 3. Obtain the details of customers who have performed at least 3 transactions. 4. List the details of branches where the number of accounts is less than the average number of accounts in all branches. d) Create the table, insert suitable tuples and perform the following operations using MongoDB 1. Find the branch name for a given Branch_ID. 2. List the total number of accounts for each customer. e) Using cursors demonstrates the process of copying the contents of one table to a new table.
5	Consider the Book Lending system from the library- BOOKS, STUDENT, BORROWS. The students are allowed to borrow any number of books on a given date from the library. The details of the book should include ISBN, Title of the Book, author, and publisher. All students need not compulsorily borrow books. a) Mention the constraints neatly. b) Design the ER diagram for the problem statement c) State the schema diagram for the ER diagram. d) Create the above tables, insert suitable tuples and perform the following operations in SQL: 1. Obtain the names of the student who has borrowed either book bearing ISBN '123' or ISBN '124'. 2. Obtain the Names of female students who have borrowed "Database" books. 3. Find the number of books borrowed by each student. Display the student details along with the number of books.

	e) Create the table, insert suitable tuples and perform the following operations using MongoDB 1. Obtain the book details authored by "author_name". 2. Obtain the Names of students who have borrowed "Database" books. f) Write a PL/SQL procedure to print the first 8 Fibonacci numbers and a program to call the same

Course outcomes:

At the end of the course the student will be able to:

1. Develop relational database schema by using data definition language utilities.(PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)

2. Develop solutions to the broad range of query and data update problems using SQL/MongoDB, (PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)

3. Implement programmatic components for a database using PLSQL (PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)

4. Analyze the results and produce substantial written documentation (PO1, PO2, PO4, PO9, PO10, PSO1)

	Advanced Java Lab
Course Code: ISL48	**Credits: 0:0:1**
Pre – requisites:	**Contact Hours: 14P**
Course Coordinator: Mr. Shivananda S	

Sl.NO	List of Experiments
1	Write a Program that simulates a telephone that records missed incoming calls. For each missed call, store the time of call, telephone number of origin, and name of the caller if the name is available. For unlisted numbers, set the name to "private caller". Choose or extend the most appropriate collection class and provide the following features. a. Numbers are recalled in the order they arrive b. Up to 10 numbers are recorded. When the eleventh call comes in, it is stored and the oldest call is deleted so that no more than 10 numbers are ever recorded. c. After each number display, the user can select i.To delete the call i.To display the call details (number, caller name and time). Delete the number if user specifies a number to delete. Write a helper class to represent an incoming call with fields to hold the number, name of the caller, and time of the call. Write a tester call that stores the several numbers, simulate the user pressing the missed-calls button, and finally prints the entire collection of stored calls.
2	Write a Java program using user-defined storage classes to create a book database and store it in a Collection List. a. Books collection should include title, author, publisher and price. b. Write a method to sort the books in ascending order of price and store it in another List. Maintain the book details with respect to an unique book id. c. Prompt for an author name and list all the books with the same author name. Create a new list holding all the book details with price greater than a user specified price.
3	Create a desktop java application using swings to enable an user to enter student information such as name, usn, age, address, sgpa of 4 semesters, category. a. Perform validations on all the fields. Display appropriate messages in pop up boxes to indicate wrong entries. b. On clicking of the "compute" button, find the cgpa . On clicking of the "done" button, mouse place the student details in a collection.

	c. Display the collection in a textarea on the click of a button.
4	Write a java program using Servlet to validate user login information using dialog boxes. a. Once validated, allow the user to enter the customer id, if the person is a new customer, else check whether the customer exists in a collection and obtain the customer id. b. The customer id can be obtained given a mobile number. Allow the user to enter the item purchased by giving the item id and quantity purchased. c. On clicking of a button, the item name and the total cost should appear in the corresponding GUI components. d. Using option dialog box, indicate the types of discount available for the customer. On clicking on the print button, print the details in information dialog box.
5	Write a program that uses Java Swing and JDBC to create a stand-alone application: a. Create two tables namely, Representative (RepNo, RepName, State, Comission, Rate) and Customer (CustNo, CustName, State, Credit_Limit, RepNo) in MySQL database. Use appropriate Swing components to insert values in a form. b. Use another form to display Representative's information when Credit_Limit is above 15,000.
6	Write a JSP and Servlet Program to do the following to buy a T-Shirt online: a. A set of checkboxes to select your T-Shirt accessories such as 'belt', 'cap', 'hair-band' etc. b. A text area / text field to enter your T-Shirt tag-line, A Radio-button that allows the user to choose between T-Shirt with chest pocket and without. A Combo Box to choose your T-Shirt color, A Button called "Click Me" c. Insert the details entered into a table called 'TShirts'. d. An Order No is generated by adding '1' to the existing 'OrderNo' e. If 'TShirts' table is empty the initial value of 'OrderNo' is 100. f. This 'OrderNo' is also inserted into the 'TShirts' table g. Display all the records of the 'TShirts' table in tabular form PS: Frontend display should be in JSP and the business logic should be written in Servlet Class.
7	Create the following application with Struts2 and Hibernate framework a. Create a Telephone Directory Application that searches the database based on phone number or name. Also show database table creation with inserting 2-3 values to the table. b. Database Name: OnlineDirectory, Table Design: Table Name: Telephone_Directory, Attributes: Phone_Number, Name, Address, Company, Pin_Code.
8	Create the following application with Struts2 and Hibernate framework a. Create two tables Flight (Flight_Number, Airline_Name, Weekdays) and seat Reservation (Flight_Number, Date, Seat_Number, Customer_Name, Customer_Phone) in

	MySQL database.
	b. Create JSP page *ReserveOnline.jsp* to reserve an airline seat and insert the values into the table Seat Reservation. On Click of Submit in *ViewDetails.jsp* display information about reservation. Validate the Flight_Number from already existing Flight database and generate random number for Seat_Number within the range 1-500.
	c. Also create a link to display information of all the flights running on a particular day.

Course outcomes:

At the end of the course the student will be able to:

CO1: Apply Collection Framework to solve given problem (PO - 1, 2, 3, 4, 5, 9, 10 & PSO - 3)

CO2: Apply JDBC concepts to work with structured data (PO - 1, 2, 3, 4, 5, 9, 10 & PSO - 3)

CO3: Apply struts and hibernate to develop web applications (PO - 1, 2, 3, 4, 5, 9, 10 & PSO - 3)

UI/UX	
Course Code: ISAEC491	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Dr. Shashidhara HS	

Course Content

Unit-1
Usability to user experience, Emotional impact as part of user experience, User experience needs a business case, Needs & Requirements, Formal requirement extraction, Methods for requirement extraction
Unit-2
Design Thinking, Design Perspectives, User Personas, Ideation, Sketching, Storyboards, Design influencing user behaviour
Unit-3
Detailed Design, Wireframes, UX Goals, UX Measures, Measurement instruments, UX Metrics
Unit-4
Depth & breadth of a prototype, Fidelity of prototypes, Paper prototypes, Using and interpreting design guidelines, Human memory limitations
Unit-5
UX design guidelines & examples, Planning, Translation, Physical action, Outcomes, Assessment, Foundations for success in SE-UX development, The challenge of connecting SE and UX
Course outcomes   At the end of the course, the student will be able to: CO1: understand the importance of User Experience and User Interface design in application development (PO - 2, 3, 5, 9, 10 & PSO - 1)   CO2: Design low fidelity and high fidelity user interfaces (PO - 2, 3, 5, 9, 10 & PSO - 1)   CO3: Assess the effectiveness of user interfaces (PO - 2, 3, 5, 9, 10 & PSO - 1)
Suggested Learning Resources: **Text Books**

Rex Hartson, Pardha S Pyla, The UX Book, Process and Guidelines for Ensuring a Quality User Experience, Morgan Kauffman

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=c9Wg6Cb_YlU
- https://www.youtube.com/watch?v=IOVFRMuPeVQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Design UI for web or mobile app.

Cybercrime and cyber laws	
Course Code: ISAEC492	**Credits: 1:0:0**
Pre – requisites: Nil	**Contact Hours: 14L**
Course Coordinator: Dr.Geetha V	

Course Content

Unit-1
Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, Cybercrimes: An Indian Perspective, Hacking and the Indian Laws, A Global Perspective on Cybercrimes.
Unit-2
Cyber offenses: How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking.
Unit-3
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography.
Unit-4
Phishing and Identity Theft: Introduction, Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing Scams, Phishing Toolkits and Spy Phishing.
Unit-5
Cybercrime and the legal Landscape around the world, why do we need Cyberlaws: The Indian Context, The Indian IT Act, Digital Signatures and the Indian IT Act, Cybercrime and Punishment.

Course outcomes

At the end of the course, the student will be able to

1. Explain the Cybercrime Terminologies. (PO-3, PO-6, PO-8 & PSO - 1)

2. Describe Cyber offences and Botnets. (PO-3, PO-6, PO-8 & PSO - 1)

3. Illustrate Tools and Methods used in Cybercrime. (PO-5, PO-6, PO-8 & PSO - 1)

4. Explain Phishing and Identity Theft. (PO-3, PO-6, PO-8 & PSO - 1)

5. Justify the Need of Computer Forensics. (PO-3, PO-6, PO-8 & PSO - 1)

Suggested Learning Resources:

Text Book:

Sunit Belapure, Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 97881- 265-21791, 2011, First Edition (Reprinted 2018).

Reference Book:

Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigations", John Wiley & Sons, ISBN: 978-1-118-69711-5, 2014.

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/106106248

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Literature Review

JavaScript and JQuery

Course Code: ISAEC493	**Credits: 1:0:0**
Pre – requisites: Nil	**Contact Hours: 14L**
Course Coordinator: Dr. Sumana M	

Course Content

Unit-1
Javascript: Statements, Built-in functions, Types of Data, Variables, Arrays, Conditional Statements, Looping, Functions, Javascript Libraries
Unit-2
JQuery: Adding JQuery to a page, Modifying Web Pages, Document Object Model, Selecting Page Elements, Adding Content, Tag and HTML Attributes
Unit-3
Introducing Events, JQuery Event Concepts, Event Management
Unit-4
JQuery Effects , Performing an action on completion of effects, JQuery Transitions and CSS3 transitions and animations.
Unit-5
JQuery usage for images, links. Forms using Javascript, JQuery Validation
Course outcomes   **At the end of the course, the student will be able to**   CO 1: Apply javascript constructs to solve the given problems (PO - 1, 2, 3, 4, 5 & PSO - 3)   CO 2: Apply JQuery to build web pages (PO - 1, 2, 3, 4, 5 & PSO - 3)   CO 3: Validate forms using javascript and JQuery (PO - 1, 2, 3, 4, 5 & PSO - 3)
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning   ●   Programming Assignment