RAMAIAH
Institute of Technology

CURRICULUM

Outcome Based Education

(Effective from the Academic Year 2024 – 2025)

INFORMATION SCIENCE AND ENGINEERING

III & IV SEMESTER B.E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

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 18 UG programs and 13 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 has 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 70% 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. **Ramaiah Institute of Technology has obtained All India Rank 182 in "Scimago Institutions Rankings" for the year 2024.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. 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. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, 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, Ramaiah Institute of Technology has achieved 75th rank among 1463 top Engineering Institutions & 21st Rank for School of Architecture in India among 115 Architecture Institutions, for the year 2024.

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

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. 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:

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

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.

Semester wise Credit Breakdown for B.E Degree Curriculum Batch 2023-27

Semester / Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03	--	--	--	--	22
Engineering Sciences (ESC)	09	08	--	--	--	--	--	--	17
Humanities, Social Sciences and Management (HSMC)	02	02	--	--	03	03	--	--	10
Ability Enhancement Course (AEC)	01	02	01	01	01	--	03	--	09
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Professional Core Courses (PCC)	--	--	11	12	12	06	04	--	45
Integrated Professional Core Course (IPCC)	--	--	04	04	03		04	--	15
Professional Elective Courses (PEC)	--	--	--	--	03	06	03	--	12
Institutional Open Elective Courses (IOE)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	✔	--	--	--	05	05
Mini Project / Project Work (PW)	--	--	--	--	--	04	--	13	17
Non Credit Mandatory Courses (NCMC)	--	--	--	--	✔	--	--	✔	--
Total Credits	20	20	21	20	22	22	17	18	160

B.E. in Information Science and Engineering
Scheme of Teaching and Examination 2024-25
(Effective from the academic year 2023-24)

III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	L	T	P	Total	Total contact hours /week
1	IS31	Laplace Transforms & Vector Space	Maths	BSC	2	1	0	3	4
2	IS32	Digital Systems and Computer Organization	ISE	IPCC	3	0	1	4	5
3	IS33	Data Structures	ISE	PCC	3	0	0	3	3
4	IS34	Operating Systems	ISE	PCC	3	0	0	3	3
5	IS35	Discrete Mathematical Structures	ISE	PCC	2	1	0	3	4
6	ISL36	Data Structures Lab	ISE	PCC	0	0	1	1	2
7	ISL37	Unix System Programming Lab	ISE	PCC	0	0	1	1	2
8	UHV38	Universal Human Value Course	ISE	UHV	2	0	0	2	2
9	ISAEC39X	Ability Enhancement Course- III	ISE	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 *	Maths	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

Nomenclature: BSC: Basic Science Course**, IPCC:** Integrated Professional Core Course**, PCC:** Professional Core Course**, 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 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 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): Student shall select any one of the NCMC 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. The above mentioned NCMC 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. 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. 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, Intra Institutional Internship:** All the students admitted under the lateral entry category shall have to undergo a mandatory summer Internship of 02 weeks which is an NCMC course, during the intervening vacation of the III and IV semesters. Summer Internship shall include Intra Institutional activities. The internship shall be considered as a head of passing in IV semester. Those, who do not take up / complete the internship shall be declared fail and shall have to complete after satisfying the internship requirements during subsequent semesters.
* 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. In case 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.

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 2024-25** **(Effective from the academic year 2023-24)**							
		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	Maths	BSC	2	1	0	3	4
2	IS42	Micro Controller	ISE	IPCC	3	0	1	4	5
3	IS43	Design and Analysis of Algorithms	ISE	PCC	3	0	0	3	3
4	IS44	Database Management Systems	ISE	PCC	3	0	0	3	3
5	IS45	Advanced Java	ISE	PCC	3	0	0	3	3
6	ISL46	Design and Analysis of Algorithms Lab	ISE	PCC	0	0	1	1	2
7	ISL47	Database Management Systems Lab	ISE	PCC	0	0	1	1	2
8	ISL48	Advanced Java Lab	ISE	PCC	0	0	1	1	2
9	ISAEC49X	Ability Enhancement Course - IV	ISE	AEC	1	0	0	1	1
10	INT410	Inter/ Intra Institutional Internship	ISE	NCMC	0	0	0	0	-
				Total	15	1	4	**20**	**25**
11	AM41	Additional Mathematics II *	Maths	NCMC	0	0	0	0	-

Ability Enhancement Course- IV

S.No.	Subject Code	Subject Name
1	ISAEC491	UI/UX
2	ISAEC492	Cyber Forensics
3	ISAEC493	JavaScript and JQuery

Nomenclature: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT –**Internship, **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 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 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.
* 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.
Internship - All the students admitted shall have to undergo mandatory internship of 6 - 8 weeks during the intervening vacation of the IV & V semesters / intervening vacation of VI & VII semesters/ VIII semester. **A Viva-Voce CIE examination** shall be conducted during VIII semester as per the rubrics defined by the department and the prescribed credits shall be included in VIII 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.
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 student's 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	
Subject Code: IS31	**Credits: 2:1:0**
Pre requisites: Calculus and Basics of Linear Algebra	**Contact Hours: 28L+14T**
Course Coordinator: Dr. Govindaraju M V	

Course Content
Unit I
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.
- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105134/
  https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording: https://a.impartus.com/ilc/#/course/119640/593
  https://a.impartus.com/ilc/#/course/59742/295

Unit II
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.
- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105134/
  https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording: https://a.impartus.com/ilc/#/course/119640/593
  https://a.impartus.com/ilc/#/course/59742/295

Unit III
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.
- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/102/111102152/
- Impartus recording: https://a.impartus.com/ilc/#/course/621524/1030
  https://a.impartus.com/ilc/#/course/619570/1030

Unit IV
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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/102/111102152/
- Impartus recording: https://a.impartus.com/ilc/#/course/621524/1030
  https://a.impartus.com/ilc/#/course/619570/1030

Unit V

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.

- Pedagogy/ Course delivery tools: Chalkand talk, PowerPoint Presentation,Videos
- Links:-https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/102/111102152/
- Impartus recording: https://a.impartus.com/ilc/#/course/621524/1030
  https://a.impartus.com/ilc/#/course/619570/1030

Text Books:

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

Reference Books:

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

Course Outcomes (COs):

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

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

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE):	100	CO1, CO2, CO3, CO4, CO5

DIGITAL DESIGN 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 I

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 code for simple circuits.

Unit II

Combinational Logic: Introduction, Design Procedure, Binary Adders, BCD Adder, Decoders, Encoders, Multiplexers and Demultiplexers. HDL for Combinational Circuits. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops. Synchronous and Asynchronous counters. HDL for Sequential logic Circuits.

Unit III

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, Instructions and Instruction sequencing, Addressing Modes.

Unit IV

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 V

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 Simulation Programs:

1. Verilog codes for combinational logic circuits.
2. Verilog program for Adder and Subtractor.
3. Verilog program for Decimal adder.
4. Verilog program for Decoders and Encoders.
5. Verilog program for Multiplexer and Demultiplexer.
6. Verilog program for flip flops.
7. Instruction Execution using Marie Simulator.
8. ALU design using Logisim simulator.

9. Memory operation using Logisim simulator.
10. Pipelining demonstration using CPU-OS simulator.

Text Books:

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

Reference Books:

1. Donald P Leach, Albert paulMalvino and Goutam Saha, Digital Principles and Applications, Seventh Edition, Tata McGraw Hill.
2. Stephen Brown,ZvonkoVranesic, Digital Logic Design with VHDL,Second Edition, Tata McGraw Hill.

Course outcomes (COs):

At the end of the course, the student will be able to:
CO1: Apply various simplification techniques to realize digital circuits using basic and universal gates. (PO1,2,3,5,9,10 & PSO2)
CO2: Design different types of combinational and sequential circuits to develop digital system. (PO1,2,3,4,5,9,10 & PSO2)
CO3: Describe the fundamentals of machine instructions, addressing modes to evaluate Processor performance. (PO1 & PSO2)
CO4: Understand the various methods used for communication between processor and I/O devices for data and control flow. (PO1 & PSO2)
CO5: Analyse internal Organization of Main Memory/Cache to evaluate Processor Performance. (PO1,2 & PSO2)

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106105185

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

- Coding Demo

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 I

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 II

Recursion: definition, processes, and programming examples Queues: Definition, Representation, Primitive operations of queue and its implementation; Circular queues and Priority queues

Unit III

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 IV

Trees: Binary Trees, Binary Tree Representations, Representing Lists as Binary trees, Trees and their applications; Binary Search Tree, Tree traversals, Graphs in data structures

Unit V

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

Course Outcomes (COs):

At the end of the course, the student will be able to:
1. Apply LIFO principle for stack related problems (PO1, PO2, PO3, PO9, PO10, PO12 & PSO-1)
2. Analyze the importance of queue data structure and its types for solving real-world problems. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)
3. Design an effective solution for a given problem using linked list. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)
4. Apply nonlinear data structures to perform various operations on data (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)
5. Apply hashing techniques for efficient storage and retrieval of data. (PO1, PO2, PO3, PO9, PO10, PO12 & PSO1)

Suggested Learning Resources:

Text 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

Reference Book:

1. Ellis Horowitz , Sartaj Sahni , Susan Anderson-Freed,"Fundamentals of Data Structures In C", 2nd edition, 2008

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 I
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 II
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 III
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 IV
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 V
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 (COs):
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:

Text Books:

1. 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 I

Fundamentals: Sets and subsets, operations on sets, Sequences. Logic: Propositions and Logical Operations, Conditional statement, methods of proofs.

Unit II

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 III

Functions: Types of Functions, Functions for computer science, permutation functions, , POSETS: order relations and structures: extremal elements of partially ordered sets, lattices.

Unit IV

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

Unit V

Semi-Groups and Groups: Binary operations revisited: Tables, semigroups: sub semigroup, sub monoid, isomorphism, homomorphism, Groups.

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 proof using laws.
4. Validating the logical statements using methods of proofs.
5. Representation of 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. Identifying lattices and verifying different types of lattices.
10. Terminologies in graphs and their models.
11. Identifying the graph Connectedness.
12. Problems related to Euler, Hamilton paths/circuits
13. Problems on binary operations and their properties.
14. Verifying different properties representing Group, semigroups

Text 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.

Reference Books:

1. Ralph P.Grimaldi, B.V Ramana, Discrete and Combinatorial Mathematics, Fifth edition.
2. J.P.Trembly, R. Manohar, Discrete mathematical structures with applications to Computer Science, McGraw Hill

Course Outcomes (COs):

At the end of the course, students 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)

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

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

Course Content

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 (COs):

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	

Course Content

Unit I

Part – A

1. Write a shell program that creates a student database file which consists of sid, sname, ssem, dept. Display only Student Name, Department, and frequency of occurrences of students belonging to respective departments.
2. Write a shell program which takes two file names as arguments, if their contents are the same then remove the second file.
3. Write a shell program that takes a command line argument and reports on whether it is directory, a file, or something else.
4. Write a shell program that accepts one or more file names as arguments and converts all of them to uppercase, provided they exist in the current directory.
5. Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permission and otherwise output each file name followed by its permissions.
6. Write a shell program to do the followings on strings:
    i.   find length of a string
    ii. check whether string is NULL
    iii. check if two strings are equal or not.
7. Write a shell program to prints the arguments in reverse order
8. Write a shell program to print the given number in reversed order.
9. Write a shell program to print the first 25 Fibonacci numbers.
10. Write a shell program to print the prime numbers between the specified range   .
11. Write a shell program to search the given key element using linear search.
12. Write a shell program to find the largest of three numbers using a function.

Part - B

1. Write a C/C++ program to implement UNIX commands ln, mv, rm commands using APIs.
2. Write a program in C/C++ to display the contents of a named file on standard output device., Also Write a program to copy the contents of one file to another.
3. Write a C program that reads every 100th byte from the file, where the file name is given as command -line argument
4. Write a C program to display information of a given file which determines type of file and Inode information, where the file name is given as command line argument.
5. Write a C program to create a process by using   fork () and vfork() system call
6. Write a program to demonstrate the process is Zombie and to avoid the Zombie process.
7. Write a C program to create an Orphan Process.

8. Write a C program to demonstrate a parent process that uses wait() system call to catch the child 's exit code.
9. Write a Program to demonstrate race condition.
10. Write a program to implement UNIX system (), using APIs.
11. Write a C/C++ program to catch, ignore and accept the signals, SIGINT.
12. 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 (COs):

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

CO1: Design shell scripts to solve given real word modules. (PO1, PO2, PO3, PO9, PO10, PSO1)

CO2: Apply appropriate API to handle various file related operations (PO - 1, 2, 3, 4, 5 & PSO - 1)

CO3: Apply appropriate APIs to manage and control the processes (PO - 1, 2, 3, 4, 5 & PSO - 1)

UNIVERSAL HUMAN VALUES	
Course Code: UHV38	**Credits: 2:0:0**
Pre – requisites: Nil	**Contact Hours: 28L**
Course Coordinator: Mr. Mushtaq Ahmed D M	

Course Content
Unit I

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 II

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 III

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 IV

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 V

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 (COs):

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:

Text Books:

1. **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

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 I

Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.

Unit II

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 III

Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures

Unit IV

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 V

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 (COs):

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:

Text Books:

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

References:

1. 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: Nil	**Contact Hours: 14L**
Course Coordinator: Dr. Krishna Raj P M	

Course Content

Unit I

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 II

Measurement: Units of Capacity: Aspects of Capacity Tracking Tools, Applications of Monitoring

Unit III

Measurement: API Usage and Its Effect on Capacity, Examples and Reality,
Predicting Trends: Riding Your Waves

Unit IV

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 V

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 (COs):

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:
1. 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: Nil	**Contact Hours: 14L**
Course Coordinator: Kavya K S	

Course Content

Unit I

Introduction to Python: Overview of Python, basic syntax, Variables, data types, and operators, Control structures (if statements, loops) and functions

Unit II

Numpy: Creating Arrays, Indexing and Slicing, Data Type Objects, dtype

Unit III

Numpy Arrays: Numerical Operations on Numpy, Arrays Concatenating, Flattening and Adding Dimensions , Boolean Indexing

Unit IV

Matplotlib : Line plot, bar plot , histograms, scatter plots, label on axes, multiple plots
Pandas: Series Data Structure – Introduction , Indexing, PANDAS.SERIES.APPLY

Unit V

Pandas: Filtering, creating series from dictionaries, Dataframe: need of Dataframes, Dataframes from dictionaries, accessing rows , accessing columns, rearranging, sorting, adding rows and columns

Course Outcomes (COs):

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:

Text Books:

1. Data Analysis: Numpy, Matplotlib and Pandas, Bernd Klein
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

ADDITIONAL MATHEMATICS – I

Course Code: AM31	Credits: 0:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Shashi Prabha Gogate S	

Course Content
Unit I
Differential Calculus: Successive differentiation, nth derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor's and Maclaurin's expansions.

- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit II
Integral Calculus: Introduction, Reduction formula, Reduction formula for , and . Evaluation of double and triple integrals.

- Pedagogy / Course delivery tools:-Chalk and talk
- Links-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit III
Vector Algebra: Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit IV
Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector. Laplace's operator. Vector identities connected with gradient, divergence and curl.

- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit V
First Order Differential Equations: Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

- Pedagogy / Course delivery tools:-Chalk and talk, Power Point Presentation
- Links:-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/59742/295

Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th Edition, 2015.

Reference Books:

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998.
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

Course Outcomes (COs):

At the end of the course the student will be able to
1. Solve problems related to nth derivative to some standard functions, polar curves and power series expansions. (PO-1,2)
2. Apply the concept of reduction formula to determine the length, area, volume of revolution of an arc of the curve. (PO-1,2)
3. Solve the problems related to velocity and acceleration. (PO-1,2)
4. Apply vector differentiation to identify solenoidal and irrotational vectors. (PO-1,2)
5. Apply the concept of various methods to solve first order first degree differential equations. (PO-1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5

STATISTICS, PROBABILITY AND LINEAR PROGRAMMING

Course Code: IS41	**Credits: 2:1:0**
Pre – requisites: Basic Probability	**Contact Hours: 28L + 14t**
Course Coordinator: Dr. Shashi Prabha Gogate S	

Course Content
Unit I

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.

- Pedagogy/Course delivery tools:-Chalk and talk, Power Point Presentation, Videos
- Links-https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording: -https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/132243/636
  https://a.impartus.com/ilc/#/course/119635/593

Unit II

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.

- Pedagogy/Course delivery tools:-Chalk and talk, PowerPoint Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/119635/593

Unit III

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.

- Pedagogy/Course delivery tools:-Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111103022
- Impartus recording: -https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/119635/593

Unit IV

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.

- Pedagogy/Course delivery tools:-Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111/105/111105035/
  https://nptel.ac.in/courses/111/107/111107119/

Unit V

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.

- Pedagogy/Course delivery tools:-Chalk and talk, Power Point Presentation, Videos
- Links:-https://nptel.ac.in/courses/111104027

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 – 9th edition – 2012.
2. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 44th edition-2017.
3. T. Veerarajan- Probability, Statistics and Random processes – Tata McGraw-Hill Education – 3rd 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- 10th 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 -4nd edition-2012.
4. Kishore S. Trivedi – Probability & Statistics with Reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.
5. Johnson/Miller: Miller & Freund's Probability and Statistics for Engineers , Eighth Edition, Pearson Education India -2015

Course Outcomes (COs):

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)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE):	100	CO1, CO2, CO3, CO4, CO5

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 I

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 II

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 III

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 IV

Assembly Language Programming, Accessing Memory, Programming of ARM7 using C, ARM7 SOC.

Unit V

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 (COs):

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:

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 I

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 II

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 III

Dynamic Programming: Warshall's and Floyd's Algorithms, The Knapsack Problem. Greedy Technique: Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.

Unit IV

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 V

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 (COs):

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:

Text Book:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

Reference Books :

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

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: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. Savita K Shetty	

Course Content
Unit I

Introduction to DBMS: Introduction, Characteristics of database approach, Actors on the scene, Workers behind the scene. Advantages of using DBMS approach. When not to use DBMS**.**

Database System Concepts: Data Models, Schemas and Instances, Three-schema architecture and data independence. Database languages and interfaces; Classification of Database Management systems.

Entity Relationship Model: Using High Level conceptual data for database design, an example database application**.** Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types. Refining the ER Design; ER Diagrams, naming conventions and design issues.

Unit II

Relational Model and Relational Algebra: Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations.

Unary relational Operations select and project. Relational algebra operations from set theory. Binary relational operations, join and division. Additional relational operations example of queries in relational algebra. Relational Database Design using ER- to-Relational Mapping.

Unit III

SQL-Structured Query Language

SQL Data Definition and Data Types, the create table command in SQL, attribute data types and domains. Specifying basic attribute constraints and defaults in SQL; Specifying key and referential integrity constraints. Schema change statements in SQL; DROP command and Alter Command. Basic queries in SQL: The select from where structure of basic SQL queries, Unspecified where clause and use of the asterisk, Aliasing, Substring Pattern Matching and arithmetic Operators, Ordering of query results. Complex SQL Queries: Comparisons Involving null and three valued logics, nested queries, the exists and unique functions in SQL. Joined tables in SQL. Aggregate functions, Group by and having clauses. Insert, Delete and Update statements in SQL.

Unit IV

Database Design: Informal Design Guidelines for Relation Schemas, reducing the null values in tuples, disallowing the possibility of generating the spurious tuples. Definition of Functional Dependencies, inference rules for functional dependencies. Normal Forms Based on Primary Keys-1NF, 2NF, 3NF, BCNF with examples. Codd rules

Unit V

Introduction to Transaction Processing: Single user versus multi user transactions, Read and Write operations. Transaction and System Concepts, Desirable properties of Transactions, Transaction Support in SQL, Need of concurrency control and recovery. Two-phase Locking Techniques for

Concurrency Control, Recovery techniques based on Deferred Update, Recovery techniques based on Immediate Update.

Introduction to NoSQL: Why NoSQL? characteristics and types of NoSQL database. Use of NoSQL in industry, SQL versus NOSQL.

Introduction to MongoDB: What is MongoDB? Why? Data Types and introduction to MongoDB Query Language.

Course Outcomes (COs):

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:

Text Book:

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.
2. Seema Acharya and Subhashini Chellappan:Big data Analytics, First Edition,Wiley India Private Limited, 2015

Reference Books:

1. Silberschatz, Korth and Sudharshan: "Data base System Concepts, Fifth Edition, Mc-GrawHill, 2006".
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems, Third Edition", McGraw-Hill, 2003. 3. Kyle Banker Peter Bakkum Shaun Verch Douglas Garrett Tim Hawkins "MongoDB Action 2nd Edition"

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: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. Shashidhara H S	

Course Content

Unit I

Handling Characters and Strings: The string Class and Its Methods, Mutable Strings with StringBuilder and StrinfBuffer, Converting Primitives to Strings
Introduction to Data Structures and Algorithms: Lists and Sets

Unit II

Generics<T>: Introduction to Java Generics, Implementing Generics
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

Unit III

Functional Programming, Functional Interfaces from the java.util.function Package
Concurrent Programming: Concurrency and Parallelism, Generating Existing Threads and New Threads, Thread Members and States, Executor Interface and Thread Pools

Unit IV

Introducing Swing – The Swing packages, Event handling, Exploring Swing
Working with Databases – JDBC Drivers and Architecture, Accessing Databases, The Customers GUI Example

Unit V

Java Servlets – Introduction, Servlet API and Life Cycle, Working with Servlets
Java Server Pages – Introduction to JSP, Getting started with JSP

Course Outcomes (COs):

At the end of the course, the student will be able to:
   CO1: Write applications using Collection package (PO - 1, 2, 3, 4, 5 & PSO - 3)
   CO2: Write applications using java generics and/or lambads (PO - 1, 2, 3, 4, 5 & PSO - 3)
   CO3: Implement applications using functional style programming   (PO 1, 2, 3, 4, 5- & PSO - 3)
   CO4: Develop applications using Swing and JDBC (PO 1, 2, 3, 4, 5, 9, 10 & PSO - 3)
   CO5: Develop JavaEE application using Servlets or JSP (PO -1, 2, 3, 4, 5, 9, 10 & PSO - 3)

Suggested Learning Resources:

Text Books:

1. Christian Ullenboom, Java: The Comprehensive Guide, Shroff Publishers, October, 2022
2. Sharanam Shah, Vaishali Shah, JavaEE 7 for Beginners, Shroff Publishers, 2018

References:

1. Herbert Schildt, Java:the Complete Reference, 12th edition, McGrawHill, , 2023 (for Swing part)

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: IS46	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Mrs. Shanmuga Priya R	

Course Content

List of Experiments:

1. Given an array of elements 'n', search for an element in this array. Indicate the number of comparisons for varying values of n. The element to be searched can be the first element, last element, element other than first and last. Assume the number of elements 'n', derive a formula to indicate the number of comparisons done. Use the following search techniques
   - Linear Search
   - Binary search

2. Write programs for each of the following and plot the time complexity for varying values of n. Indicate the parameter 'n' and the basic operations.
   a. To find the sum of all the elements of the array.
   b. To find the binary equivalent of a given decimal number.
   c. Read a matrix and print those elements of the matrix that are even.

3. 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.

4. 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

5. 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.

6. Consider the problem of searching for a pattern in a given string. Design a 'C' program to locate the pattern using Horspool's algorithm. Give the trace of this algorithm.

7. Consider a network of 'n' cities which is represented as a Graph.
   a. Write a 'C' program to find the transitive closure of such a network using Warshall's algorithm.
   b. Write a 'C' program to find the shortest paths between all cities using Floyd's algorithm.

   Note : Give the trace of both algorithms.

8. 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.

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 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

11. 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

12. 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

13. 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 (COs):

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: Nil	**Contact Hours: 14P**
Course Coordinator: Mrs. Kusuma S	

Course Content
Unit I

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
      i.   Obtain the details of employees assigned to "Database" project.
      ii. Find the number of employees working in each department with department details.
      iii. 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
      i.   List all the employees of Department named #Dept_name.
      ii. 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
   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:
      i.   Obtain the details of parts supplied by supplier #SNAME.
      ii. Obtain the Names of suppliers who supply #PNAME.
      iii. Delete the parts which are in #PCOLOR.
   e) Create the table, insert suitable tuples and perform the following operations using MongoDB
      i.   Update the details of parts for a given part identifier: #PID.
      ii. 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:
   i. Obtain the details of the boats reserved by '#Sailor_Name'.
   ii. Retrieve the BID of the boats reserved necessarily by all the sailors.
   iii. 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.
   i. Obtain the number of boats obtained by sailor :#Sailor_Name
   ii. 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:
   i. Obtain the details of customers who have both Savings and Current Account.
   ii. Retrieve the details of branches and the number of accounts in each branch.
   iii. Obtain the details of customers who have performed at least 3 transactions.
   iv. 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
   i. Find the branch name for a given Branch_ID.
   ii. 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:
   i. Obtain the names of the student who has borrowed either book bearing ISBN '123' or ISBN '124'.
   ii. Obtain the Names of female students who have borrowed "Database" books.
   iii. 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
    i. Obtain the book details authored by "author_name".
    ii. 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 (COs):

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)
2. Implement programmatic components for a database using PLSQL (PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)
3. Analyze the results and produce substantial written documentation (PO1, PO2, PO4, PO9, PO10, PSO1)

ADVANCED JAVA LAB	
Course Code: IS48	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Mrs. Evangeline D	

Course Content

List of Experiments

1. Write program to demonstrate the working of String methods for:
    a. To determine frequency of substrings in a string
    b. Hangman game (guess all letters in a word)
    c. To check for anagrams (two strings having same characters)
2. Write a program to create generic Stack class with push(), pop(), clear(), iSEmpty() and display() methods. Demonstrate creating Stack of String and Integer objects.
3. 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
        ii. 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.
4. 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 a 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.
5. Create a desktop java application using swings to enable a 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.

6. 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.
7. 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.
8. 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
    h. PS: Frontend display should be in JSP and the business logic should be written in Servlet Class.

Course Outcomes (COs):

At the end of the course the student will be able to:
  CO1: Apply Collection Framework Generics & Swings 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 JSP and Servlet 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: Mrs. Charunayana V	

Course Content

Unit I

The importance of the user interface: Defining the user interface, the importance of good design, the benefits of good design. **Characteristics of graphical and web user interfaces**: interaction styles, the graphical user interface, the concept of direct manipulation, graphical system : advantages and disadvantages, characteristics of the graphical user interface, the web interface, the merging of graphical business system, principles of user interface design

Unit II

The user interface design process : usability, **Know your user or client:** important human characteristic in design, **Understand the principles of good interface and screen design:** navigation flow, Visually pleasing composition, application and page size, application screen elements

Unit III

Develop system menus and navigation schemes: Structures of Menus, Functions of Menus, Content of Menus, Phrasing the Menu, Formatting of Menus, Selecting Menu Choices, Web Site Navigation, and Kinds of Graphical Menus **select the proper kinds of windows**: Window Characteristics, components of windows, Window Presentation Styles, Types of Windows, Organizing Window Functions, The Web and the Browser.

Unit IV

Interactive devices: Input Devices, output devices. **Choose the proper screen – based controls**: Operable Controls, Text Entry/Read-Only Controls, Selection Controls, Combination Entry/Selection Controls, Custom Controls, Presentation Controls, Selecting the Proper Controls.

Unit V

Organize and layout windows and pages: Organizing and Laying Out Screens. **Test, test and retest**: Usability, Prototypes, Kinds of Tests, Developing and Conducting a Test.

Course Outcomes (COs):

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: Select and use appropriate interactive devices and screen-based controls in the design of a
          user interface, based on the needs and goals of the user. (PO - 2, 3, 5, 9, 10 & PSO - 1)
    CO3: Design system menus and navigation schemes that are intuitive and user-friendly. (PO - 2,
          3, 5, 9, 10 & PSO - 1)

CO4: Select appropriate types of windows, interactive devices, and screen-based controls to enhance user interaction and improve overall user experience. (PO - 2, 3, 5, 9, 10 & PSO - 1)

CO5: Applying feedback to iterative testing processes, refine and improve the UI design continuously. (PO - 2, 3, 5, 9, 10 & PSO - 1)

Suggested Learning Resources:

Text Books:

1. The essential guide to user interface design, third edition, Wilbert O Galitz

Reference Book:

1. 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.

CYBER FORENSICS	
Course Code: ISAEC492	**Credits: 1:0:0**
Pre – requisites: Nil	**Contact Hours: 14L**
Course Coordinator: Dr. Geetha V	

Course Content
Unit I
Understanding the Digital Forensics Profession and Investigations: An Overview of Digital Forensics. Preparing for Digital Investigations, Preparing a Digital Forensics Investigation, Procedures for Private-Sector High-Tech Investigation

Unit II
Data Acquisition: Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Acquisition Tools, Validating Data Acquisitions

Unit III
Current Digital Forensics Tools: Evaluating Digital Forensics Tool Needs, Digital Forensics Software Tools, Digital Forensics Hardware Tools, Validating and Testing Forensics Software. Virtual Machine Forensics, Live Acquisitions, and Network Forensics: An Overview of Virtual Machine Forensics, Network Forensics Overview

Unit IV
E-mail and Social Media Investigations: Exploring the Role of E-mail in Investigations, Exploring the Roles of the Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Applying Digital Forensics Methods to Social Media Communications

Unit V
Mobile Device Forensics and the Internet of Anything: Understanding Mobile Device Forensics, Understanding Acquisition Procedures for Mobile Devices, Understanding Forensics in the Internet of Anything,

Text Book:

1. Bill Nelson, Amelia Phillips, Christopher Steuart, ― Guide to Computer Forensics and Investigations, Cengage Learning, India Sixth Edition, 2019.

Reference Book:

1. John R.Vacca, "Computer Forensics ", Cengage Learning, 2005
2. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.

Course Outcomes (COs):

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

1. Understand the basics of cybercrime and computer forensics. (PO-3, PO-6, PO-8)
2. Describe data acquisition and its tools. (PO-3, PO-6, PO-8)
3. Illustrate Tools and Methods used in Current Digital Forensics. (PO-5, PO-6, PO-8)
4. Explain E-mail and Social Media Investigations. (PO-3, PO-6, PO-8)
5. Justify the Need of Computer Forensics. (PO-3, PO-6, PO-8)

Web links and Video Lectures (e-Resources):

- https://onlinecourses.swayam2.ac.in/cec21_ge10/preview

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 I
Javascript: Statements, Built-in functions, Types of Data, Variables, Arrays, Conditional Statements, Looping, Functions, Javascript Libraries

Unit II
JQuery: Adding JQuery to a page, Modifying Web Pages, Document Object Model, Selecting Page Elements, Adding Content, Tag and HTML Attributes

Unit III
Introducing Events, JQuery Event Concepts, Event Management

Unit IV
JQuery Effects , Performing an action on completion of effects, JQuery Transitions and CSS3 transitions and animations.

Unit V
JQuery usage for images, links. Forms using Javascript, JQuery Validation

Course Outcomes (COs):

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 enhance and manipulate web pages. (PO - 1, 2, 3, 4, 5 & PSO - 3)
   CO 3: Apply jQuery to manage events in their web applications. (PO - 1, 2, 3, 4, 5 & PSO - 3)
   CO 4: Apply JQuery to create and manage a transitions and animations. (PO - 1, 2, 3, 4, 5 & PSO - 3)
   CO 5: 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

INTER/ INTRA INSTITUTIONAL INTERNSHIP

Course Code: INT410	**Credits: NCMC**
Pre – requisites: Nil	
Course Coordinator: -	

Course Content

All the students shall have to undergo a mandatory Internship of 02 weeks which is an NCMC course, during the intervening vacation of the II and III semesters. Internship shall include Intra Institutional activities across the institute. A student shall select an internship of his/her choice and attend for 02 weeks. An internal evaluation of the same will be conducted by the internship organizing department and marks scored will be sent to the parent department. A student shall register for the internship in IV semester and shall complete the internship requirements.

All the students admitted under the lateral entry category shall have to undergo this Internship of 02 weeks which is an NCMC course, during the intervening vacation of the III and IV semesters.

ADDITIONAL MATHEMATICS - II

Course Code: AM41	**Credits: 0:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. Veena B N	

Course Content
Unit I

Differential Calculus- I: Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions.
- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit II

Differential Calculus- II: Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.
- Pedagogy / Course delivery tools:-Chalk and talk
- Links-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030
  https://a.impartus.com/ilc/#/course/59742/295

Unit III

Vector Integration: Line integrals, surface integrals and volume integrals. Green's theorem, Stokes' and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.
- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105134/
- Impartus recording: -https://a.impartus.com/ilc/#/course/107625/1030

Unit IV

Higher Order Differential Equations: Higher order linear differential equations, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations.
- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: -https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/59742/295

Unit V

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability- illustrative examples. Bayes theorem – examples.
- Pedagogy / Course delivery tools:-Chalk and talk
- Links:-https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: -https://a.impartus.com/ilc/#/course/283623/703

Text Books:
1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th Edition, 2015.

Reference Books:
1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

Course Outcomes (COs):

At the end of the course the student will be able to
1. To carryout differentiation of function of several variables. (PO-1,2)
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series. (PO-1,2)
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems. (PO-1,2)
4. Find the solution of second and higher order ODEs with constant and variable coefficients. (PO-1,2)
5. Solve the problems on conditional probability and Baye's theorem. (PO-1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5