



RAMAIAH
Institute of Technology

CURRICULUM
Outcome Based Education
(Academic Year 2022 – 2023)

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

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

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 67th rank among 1249 top Engineering Institutions & 17th Rank for School of Architecture in India for the year 2022 and is 1st amongst the Engineering Colleges affiliated to VTU, Karnataka.

About the Department

Information Science and Engineering department is established in the year 1992 with an objective of producing high-quality professionals to meet the demands of the emerging field of Information Science and Engineering. Department also started M.Tech program in Software Engineering in the year 2004 and has been recognized as R&D center by VTU in 2012. The department is accredited by the NBA in 2001, 2004, 2010, 2015 and reaccredited in 2018 under Tier-1 till 2022. Department has highly qualified and motivated faculty members and well equipped state of the art laboratories. All faculty members are involved in research and technical papers publications in reputed journals, conferences across the world. Strong collaboration with industries and high profile institutions is in place for curriculum updates, more hands on training, practical's, project based learning, EPICS, expert lectures, partial course deliveries by industry experts and student interns to enhance the skills in emerging areas to keep an inclusive and diverse academic environment. Department is regularly conducting seminars, conferences and workshops for students and academicians in the emerging areas of Information Technology. Introduced EPICS in senior projects. Some of the laboratories have also been set up in collaboration with industries such as Intel, Microsoft, Apple, SECO, Honeywell, EMC2, NVIDIA, IBM, Green Sense Werks, Tech Machinery Labs, Sesovera Tech Pvt. Ltd., and Ramaiah Medical College (Emergency department). Also, an echo system is built to initiate start-ups at the department level along with the mentorship. All the above potential activities have led to high profile placements, motivation to become an entrepreneur, and encouragement for higher learning.

VISION OF THE INSTITUTE

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

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

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

QUALITY POLICY

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

VISION OF THE DEPARTMENT

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

MISSION OF THE DEPARTMENT

1. Department of Information Science and Engineering shall create high quality IT Engineering Professionals for the betterment of society by:
2. Providing education through an ever improving curriculum and effective pedagogy techniques.
3. Encouraging extra and co-curricular activities to develop their overall personality along with technical skills.
4. 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.

SCHEME OF TEACHING III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IS31	Linear Algebra & Laplace Transforms	Maths	BSC	2	1	0	3	4
2	IS32	Digital System and Computer Organization	ISE	IPCC	2	0	1	3	4
3	IS33	Data Structure	ISE	PCC	3	0	0	3	3
4	IS34	Object Oriented Programming with Java	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	Object Oriented Programming with Java Lab	ISE	PCC	0	0	1	1	2
8	UHV38	Universal Human Value Course	ISE	UHV	2	0	0	2	2
9	HS391	Kannada (Kali / Manasu)	HSS	HSMC	1	0	0	1	1
10	AEC310	Ability Enhancement Course-III		AEC	1	0	0	1	1
Total								21	26
11	PE83	Physical Education		NCCM	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	National Service Scheme (NSS)							
12	AM31	Additional Mathematics - I *	Maths	NCCM	0	0	0	0	3

**NOTE: Branches: CSE, AI & ML, AI & DS, CSE(CS), CSE (AI & ML), ISE, ECE: Kannada (Kali / Manasu) in III Semester
Constitution of India & Professional Ethics in IV Sem**

**Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT: Constitution of India & Professional Ethics in III Semester
Kannada (Kali / Manasu) in IV Semester**

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

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

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

HS39/ HS49 Kannada Manasu is for students who speak, read and write Kannada and
HS39/ HS49 Kannada Kali is for non-Kannada speaking, reading, and writing students.

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

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

*** Lateral Entry Students:**

The Non-Credit Mandatory Course, Additional Mathematics I is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured 'F' grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. 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.

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

Lateral Entry Students:

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

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

SCHEME OF TEACHING IV SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IS41	Numerical Techniques and Probability Models	Maths	BSC	2	1	0	3	4
	IS42	Operating Systems	ISE	IPCC	2	0	1	3	4
2	IS43	Design and Analysis of Algorithms	ISE	PCC	3	0	0	3	3
3	IS44	Microcontrollers	ISE	PCC	3	0	0	3	3
4	IS45	Database Management Systems	ISE	PCC	3	0	0	3	3
5	ISL46	Design and Analysis of Algorithms Lab	ISE	PCC	0	0	1	1	2
6	ISL47	Microcontroller lab	ISE	PCC	0	0	1	1	2
7	ISL48	Database Management Systems Lab	ISE	PCC	0	0	1	1	2
8	HS492	Constitution of India & Professional Ethics	HSS	HSMC	1	0	0	1	1
9	AEC410	Ability Enhancement Course – IV		AEC	1	0	0	1	1
10	INT411	Inter/Intra Institutional Internship	ISE	INT	0	0	2	2	-
				Total				22	25
11	AM41	Additional Mathematics II *	Maths	NCCM	0	0	0	0	-

NOTE: Branches: CSE, AI & ML, AI & DS, CSE(CS), CSE (AI & ML), ISE, ECE: Kannada (Kali / Manasu) in III Semester
Constitution of India & Professional Ethics in IV Sem

Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT: Constitution of India & Professional Ethics in III Semester
Kannada (Kali / Manasu) in IV Semester

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

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

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

HS39/ HS49 Kannada Manasu is for students who speak, read and write Kannada and

HS39/ HS49 Kannada Kali is for non-Kannada speaking, reading, and writing students.

Innovation/ Societal/ Entrepreneurship based Internship: At the End of fourth Semester four - weeks summer internship shall be carried out at industry, State and Central Govt./NGO/MSME, Innovation centre’s or incubation centres. The internship can be Rural Internship. All the students shall have to undergo mandatory internship of 04 weeks during the intervening period of IV & V semesters. A Viva-Voce examination (CIE) shall be conducted during V semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. The in-charge faculty has to monitor the student’s internship progress and interact to guide them for the successful completion of the internship. Innovation/ Societal/ Entrepreneurship based Internship shall have only CIE no SEE component.

*** Lateral Entry Students:**

The Non-Credit Mandatory Course, Additional Mathematics II is prescribed for IV Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil 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 II shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

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

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

III SEMESTER

LINEAR ALGEBRA & LAPLACE TRANSFORMS	
Course Code: IS31	Credits: 2:1:0
Pre – requisites: Calculus and Basics of Linear Algebra	Contact Hours: 28L+14T
Course Coordinator: Dr. Govindaraju M. V., Dr. R. Suresh Babu	

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, 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 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

Linear Transformation: Introduction to vector spaces, linear combination and span, Linearly independent and dependent vectors, Basis and Dimension, Linear

transformations, Composition of matrix transformations, Rotation about the origin, Dilation, Contraction and Reflection, Kernel and Range, Change of basis.

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

Unit IV

Vector Space: Vector Spaces, 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, 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>

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, Markov Chains, Quadratic Forms and Conic Sections.

- 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>

Text Books:

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

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, PO-2, PSO-2, PSO-3)
2. Obtain inverse Laplace transforms and use the same to solve system of ODE's ((PO-1, PO-2, PSO-2, PSO-3)
3. Obtain matrix of linear transformation and study the concept of change of basis. (PO-1, PO-2, PSO-2, PSO-3)
4. Using the concept of orthogonality of vector spaces solve the system of equations. (PO-1, PO-2, PSO-2, PSO-3)
5. Obtain eigenvalue decomposition of a matrix and using the same study the concepts of SVD and PCA. (PO-1, PO-2, PSO-2, PSO-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 SYSTEM AND COMPUTER ORGANIZATION

Course Code: IS32	Credits: 2:0:1
Pre – requisites: Basic Electronics	Contact Hours: 28L+14T
Course Coordinator: Prathima M. N.	

Course Content

Unit I

Introduction to Digital System: Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Exclusive-OR Function, Introduction to Hardware Description Language: Verilog model for simple Circuits.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106105185>
- Impartus recording: <https://a.impartus.com/ilc/#/course/81475/295>

Unit II

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Combinational Logic:** Introduction, Design procedure, Binary Adder, BCD Adder. Verilog codes for Combinational logic Circuits.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106106092>
- Impartus recording: <https://a.impartus.com/ilc/#/course/83041/295>

Unit III

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and instruction Sequencing, Addressing Modes. **Combinational Logic:** Decoders, Encoders, Multiplexers. Demultiplexer. Verilog codes for Combinational logic Circuits.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/106106092>
Impartus recording: <https://a.impartus.com/ilc/#/course/83041/295>

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: ROM, Speed, size and Cost,

Cache Memories – Mapping Functions. **Sequential Logic:** Introduction, Flip-Flops. Verilog codes for Sequential logic Circuits.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/106106092>
- Impartus recording: <https://a.impartus.com/ilc/#/course/83041/295>

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106092>
- Impartus recording: <https://a.impartus.com/ilc/#/course/83041/295>

Lab Component (Verilog codes):

- **Simple circuits**
- **Combinational Logic:** Binary Adder-Subtractor, Decimal Adder, Decoders, Encoders, Multiplexers, Demultiplexer.
- **Sequential Logic:** Flip-Flops, Register, Asynchronous counters.

Text Books:

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

Reference Books:

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

Course Outcomes (COs):

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

1. Apply the K-Map techniques to simplify various Boolean expressions. (PO1,2,3,5& PSO2)

2. Design different types of combinational and sequential circuits along with verilog programs. (PO1,2,3,5,9,10& PSO2)
3. Describe the fundamentals of machine instructions, addressing modes and Processor performance. (PO1 & PSO2)
4. Understand the approaches involved in achieving communication between processor and I/O devices. (PO1 & PSO2)
5. Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance. (PO1,2& PSO2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO4
Internal test-II	30	CO2, CO3, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Lab Component Evaluation	20	CO1, CO2, CO3
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATA STRUCTURES

Course Code: IS33	Credits: 3:0:0
Pre – requisites: Fundamentals of Computing	Contact Hours: 42L
Course Coordinator: Dr. Sumana M	

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.

- Pedagogy/Course delivery tools: Chalk and talk/Power Point Presentation, RolePlay
- Links: <https://nptel.ac.in/courses/106102064>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107791/533>

Unit II

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

- Pedagogy/Course delivery tools: Chalk and talk/Power Point Presentation, Role-play
- Links: <https://nptel.ac.in/courses/106102064>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107791/533>

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.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/106102064>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107791/533>

Unit IV

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

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation

- Links: <https://nptel.ac.in/courses/106102064>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107791/533>

Unit V

B-Tree: Searching, Insertion and Deletion

Hashing: Hash Function, Collision, Probability of Collision, Collision handling techniques, Progressive Overflow, Buckets, Chained Progressive Overflow.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106102064>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107791/533>

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 Books:

1. Horowitz and Sahani. “Fundamentals of Data Structures”, 2nd Edition, Galgotia Publication PvtLtd., New Delhi, 2011
2. Behrouz A. Forouzan and Richard F. Gilberg,” Computer Science a Structured Programming Approach using C”, Second Edition, Thomson Publications,2007.
3. R. Kruse, “Data Structures and Program Design in C”, Pearson Education, 2nd Edition, 2009.

Course Outcomes (COs):

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

1. Apply array/structure/stack data structure for a given problem statement (PO1, PO2, PO3, PO9, PO10, PO12, PSO-1)
2. Implement various operations of queue to find a solution to the problem (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
3. Implement various types of linked lists and their operations using dynamic memory allocation. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
4. Construct Binary Trees and perform various types of Tree Traversals. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
5. Apply B-Trees and hashing techniques to solve a given problem. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)

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		
Programming Assignment	20	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OBJECT ORIENTED PROGRAMMING WITH JAVA

Course Code: IS34	Credits: 3:0:0
Pre – requisites: Fundamentals of Computing	Contact Hours: 42L
Course Coordinator: Dr. S R Mani Sekhar	

Course Content

Unit I

Introducing Classes: Class Fundamentals, Declaring Objects, new operator, Object Reference Variables, Methods, Constructors, Parameterized Constructors, this Keyword, Instance Variable Hiding, Garbage Collection, finalize method.

Methods and Classes: Overloading Methods, Overloading Constructors, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, static, final, Arrays, Nested and Inner Classes, String Class, Command-Line Arguments, Varargs: Variable-Length Arguments.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/132215/636>

Unit II

Inheritance: Inheritance Basics, super, Multilevel Hierarchy, Constructors in inheritance, Method Overriding, Dynamic Method Dispatch, Overridden Methods, Abstract Classes, final with Inheritance, The Object Class.

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Defining an Interfaces, Default Interface Methods, Static Methods in an Interface

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/132215/636>

Unit III

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, try and catch, multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in exceptions, User-defined Exception Subclasses, Chained Exceptions.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/132215/636>

Unit IV

Type Wrappers: Character, Boolean, Numeric type wrappers. Autoboxing: Autoboxing and Methods, Autoboxing / Unboxing occur in expressions, Autoboxing/Unboxing Boolean and Character values.

The Collections Framework: Collections Overview, The Collection Interfaces, the List interface, the Set interface.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/132215/636>

Unit V

The Collection Classes: The ArrayList Class, The LinkedList Class, The HashSet Class. Collection and Iterator, The For-Each Alternative to Iterators.

Lambda Expression - Fundamentals, Functional Interfaces, Block Lambda Expressions, Generic Functional Interfaces, Passing lambda Expressions as Expressions, Lambda Expressions and Exceptions, lambda Expressions and Variable Capture.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/132215/636>

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, McGraw Hill

Reference Books:

1. Daniel Liang, Introduction to java Programming, Tenth edition, Pearson

Course Outcomes (COs):

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

1. Design the class using java specific constructs to solve the given problems. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
2. Develop solutions for dynamic programming by adopting the concepts of inheritance, packages and interfaces. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
3. Apply the concepts of Exception Handling to solve a given problem. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)

4. Use the Collection framework to perform data manipulation operations. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
5. Apply functional programming concepts in object oriented programming using Lambda Expressions. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)

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		
Aptitude Test	10	CO1, CO2, CO3, CO4, CO5
Programming Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DISCRETE MATHEMATICAL STRUCTURES

Course Code: IS35	Credits: 2:1:0
Pre – requisites: Nil	Contact Hours: 28L+14T
Course Coordinator: Prashanth Kambli	

Course Content

Unit I

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106094>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107790/533>

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106094>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107790/533>

Unit III

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

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106094>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107790/533>

Unit IV

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

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106094>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107790/533>

Unit V

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106094>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107790/533>

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)

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		
GATE based aptitude test	10	CO1, CO2, CO3
Problem solving Assignment	10	CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATA STRUCTURES LAB

Course Code: ISL36	Credits: 0:0:1
Pre – requisites: Fundamentals of Computing	Contact Hours: 14
Course Coordinator: Dr. Megha P Arakeri	

Course Content

1. Write a program to illustrate forward and backward surfing in the web browser using stack (Array implementation/ Linked list implementation). Display the appropriate messages in case of exceptions.
2. 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.
3. 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 /.
4. 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.
5. 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.
6. Write a program to illustrate memory allocation to files based on their size using singly linked list/doubly linked list. Program must support the following operations on a singly linked list/doubly linked list.
 - a. Inserting a node
 - b. Deleting a node
 - c. Display
7. 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 preorder traversal method.

Reference:

1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures Using C”.
2. Horowitz and Sahani. “Fundamentals of Data Structures”, Galgotia Publication Pvt Ltd., New Delhi.
3. Behrouz A. Forouzan and Richard F. Gilberg, “Computer Science a Structured Programming Approach using C”, Second Edition, Thomson Publications.
4. R. Kruse, “Data Structures and Program Design in C”, Pearson Education.

Course Outcomes (COs):

At the end of the course, students 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)

OBJECT ORIENTED PROGRAMMING WITH JAVA LAB

Course Code: ISL37	Credits: 0:0:1
Pre – requisites: Fundamentals of Computing	Contact Hours: 14
Course Coordinator: Shashidhara H S	

Course Content

1. Write Java programs
 - a. To print Fibonacci series without using recursion and using recursion. (concept of loops, data types)
 - b. To check prime numbers.
 - c. To sort an array elements using bubble sort algorithm.

2. Create a class called account with the data members (Accno – integer, name String, Phone_No: integer, balance_amt: float), and following methods:
 - a. getinput () to get input from the user
 - b. Deposit () method which takes the amount to be deposited in to his/her account and do the calculation.
 - c. Withdraw () method which gets the amount to be withdrawn from his/her account.
 - d. Print the appropriate results.

3. Define a Stack class to implement the stack data structure. Include constructors to perform initialization, method push to push an element into the stack, method pop to remove an element from the stack and display method to display the elements of the stack.

4. Define a class Complex with data members as two real numbers, constructors for initialization these numbers, methods to add, subtract and multiply 2 complex numbers.

5. Write a java program to read 2 matrices and place the product in a third matrix. Use constructors and suitable methods.

6. Write a java program to work with strings.
 - a. Extract a portion of the string and print it. Variable m indicates the amount of characters to be extracted from the string starting from the nth position.
 - b. Read a text and count all the occurrences of a particular word.
 - c. Replace a substring in the given string.

- d. Rearrange the string and rewrite in alphabetical order.
 - e. Compare two strings ignoring case.
 - f. Concatenate two strings.
7. Create a Personal class to hold the personal details of a person such as name, age, education, salary- (basic, da, hra), years of experience, number of loans and loan amount. Write constructors to assign values to the data members. Include an
- a. isEligible () method to indicate whether the person is eligible for loan,
 - b. taxPay () method to indicate the amount of tax to be paid,
 - c. isEligiblePromotion () to indicate whether the person is eligible for a promotion.
 - d. Display () method to display the details.

Enter the details of n employees and indicate their eligibility and the tax to be paid.

8. Create a Circle class with following members.
 A data member that stores the radius of a circle.
 A constructor function with an argument that initializes the radius
 A function that computes and returns area of a circle
 Create two derived classes Sector and Segment that inherit the Circle class.
 Both classes inherit radius and the function that returns the circle's area from Circle.
 In addition to the members inherited from Circle, Sector and Segment have some specific members as follows:
- Sector
1. A data member that stores the control angle of a sector (in radians)
 2. A constructor function with arguments that initialize radius and angle
 3. A function that computes and returns the area of a sector
- Segment
1. A data member that stores the length of a segment in a circle
 2. A constructor function with arguments that initialize radius and length
 3. A function that computes and returns the area of a segment
- Create the main () function to instantiate an object of each class and then call appropriate member functions to compute and return the area of a circle, sector and segment.

Note: $\text{Area_of_circle} = \pi * r^2$

$\text{Area_of_Sector} = (1/2) r^2 * \theta$

Area_of_segment = $r^2 * ((r-h)/r) - (r-h) (2rh-h^2)^{1/2}$ Where r is the radius of a circle, θ is the central angle of a sector in radians, h is the length of a segment and $((r-h)/r)$ is in radians.

9. Write a Java Program that does the following related to Inheritance:
 - a. Create an abstract class called Vehicle which contains the 'year_of_manufacture' data member and two abstract methods 'getData ()' and 'putData ()' with a constructor.
 - b. Create two derived classes "TwoWheeler" and "FourWheeler" and implement the abstract methods. Make "FourWheeler" as final class.
 - c. Create class 'MyTwoWheeler' which is a sub-class of "TwoWheeler" and demonstrate the use of super keyword to initialize data members of "MyTwoWheeler".

10. Define an interface 'Department' with methods to readdata () and printdata (), print_number_designations (), number_research_consultancy_projs (). Define a 'Faculty' class with members name, designation, age, years of experience, joining_date and subjects_handled.
 - a. In package ISE define the 'ISE_department' class that implements the 'Department' interface, accepts n faculty details and define all the methods. Raise a user defined exception 'AgeException' if the age of the faculty is > 58.
 - b. In the default package define a 'MainClass' which uses the methods of the above classes and also displays those faculty details whose years of experience is greater than or equal to 20.

11. Write a Java Program that does the following related to Packages and Interfaces, Exception Handling:
 - a. Create an interface Student which gets the name and branch of a student.
 - b. Create a package called 'StudentPackage' which has a user-defined class RegisterStudent.
 - c. If a student registers above 30 credits for the semester, the method should throw a user-defined exception called 'CreditLimit' and display an appropriate message.
 - d. Create another package called 'ResultPackage' which displays the grade for the subject registered for particular semester and the SGPA. If SGPA is above 10 then throws an InvalidSGPA user-defined exception.
 - e. In the StudentPackage, collect the marks of all the subjects in 4 semesters and calculate SGPA and CGPA.

12. a. Write a java program to implement queues of Strings using an ArrayList class of the Collection framework.
- b. Create a linked list of names (String type). Use an Iterator to traverse through the list and print those names whose length is < 5 .

Text Books:

1. Herbert Schildt, “Java: The Complete Reference”, 9th Edition, McGraw Hill

Course Outcomes (COs):

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

1. Design the experiment for the given problem using Java constructs. (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)

UNIVERSAL HUMAN VALUES

Course Code: UHV38	Credits: 2:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Sumana M	

Course content

Unit I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
 2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels
- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
 - Lab component / Practical Topics: Survey/polls for self-exploration
 - Links: Holistic Development and Role of Education <https://youtu.be/sGZtTPe-lhQ>

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.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Human Being- Self and Body
<https://youtu.be/0ERSMkRPQBM>
Links: Harmony in Human Being- Self <https://youtu.be/83oGJ4oDeIg>
Links: Harmony between Self and Body Prosperity
https://youtu.be/aJ_BU2OgpKs

Unit III

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

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
3. Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
4. Understanding the meaning of *Vishwas*; Difference between intention and competence
5. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
6. Understanding the harmony in the society (society being an extension of family):
7. *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
8. 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.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Family- Trust <https://youtu.be/F2KVVW4WNnS8>
Links: Harmony in family- Respect https://youtu.be/iLqNRPuv0_8
Links: Harmony in family- Other Feeling Justice
<https://youtu.be/TcYJB7reKnM>
Links: Harmony in the Society <https://youtu.be/BkWgFinrnPw>

Unit IV

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

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Nature https://youtu.be/K1Jpd_ojydw
- Links: Harmony in Existence https://youtu.be/mormUeZ_RUE

Unit V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
 - Definitiveness of Ethical Human Conduct
 - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
 - Competence in professional ethics:
 - A. Ability to utilize the professional competence for augmenting universal human order
 - B. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
 - C. Ability to identify and develop appropriate technologies and management patterns for above production systems.
 - Case studies of typical holistic technologies, management models and production systems
 - Strategy for transition from the present state to Universal Human Order:
- A. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
 - B. At the level of society: as mutually enriching institutions and organizations

Suggested Learning Resources:

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration

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=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZIGC4>
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

Course Outcomes (COs):

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

1. Apprehend the need of Value Education over Human aspirations (PO-6)
2. Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6)
3. Recognize the need of Harmony in the Family and Society for a better World. (PO-6)
4. Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6)
5. Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-8)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE)		
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 will be taken for 30 marks.		
Other components		
<ul style="list-style-type: none">• Assignment• Quiz• Presentation• Model / mini project• Any other	20 (10 + 10)	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

KANNADA KALI	
Course Code: HS391K	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Mrs. Kanya Kumari.S	

Unit I

(Parichaya) - Introduction

Kannada Bhashe - About Kannada Language, Eight Kannada Authors – JnanpiTh Awardies

Introduction to Kannada Language, Karnataka State and Literature.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit II

naamapadagaLu – Sarva namapadagaLu – (Nouns -Pronouns) and it’s usage in Kannada

Kannada namavisheshanagaLu - (Adjectives-Interrogatives)

kriyapadagaLu, kriya visheshaNagaLu- (verb-adverb)

Sambhashaneyalli Prashnarthaka padagalu –vaakyagaLu mattu kriyapadagaLu- visheshaNagaLu (Kannada- Interrogative words & Sentences and verb-adverb in Conversation)

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit III

Samanya Sambhashaneyalli Kannadada Padagalu mattu Vaakyagalu

(Kannada Words and Sentences in General Conversation with activities)

sambhashaNe: (Conversation with Friends- Teachers, between Friends)

(Conversation in Shop, Hostel, Market, Bus and Train)

Shabdakosha: Vocabulary – chaTuvaTike: Exercises

Vicharaneya / Bedikeya vakyagalu(Enquiry /Request sentences in Conversation)

Sambhashane Conversation with House Owner and Room mate

Shabdakosha – Vocabulary - Exercises to test their knowledge of understanding the Language.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit IV

Kannada padagaLu (eakavachana,bahuvachanagaLu,virudda padagaLu dina nityadalli baLasuva padagaLu mattu sankya vyavaste

Sambhashaneyalli Eakavachana mattu Bhahuvachana- (Singular and Plural nouns)

Conversation- Sambhashaneyalli Linga rupagaLu- Genders in Conversation

Viruddha padagalulu /Viroddharthaka padagalulu (Antonyms) Asamanjasa Uchcharane (Inappropriate Pronunciation)

Sankhya Vyavasthe(Numbers system) -Samaya /Kalakke Sambhandhisida padhagalulu (Words Relating to time) – Dikkugalige sambhadhisida padhagalulu (Words Relating to Directions)

Aaharakke sambandhisida padagaLu(Names connected with food)

Manavana shareerada bhagalulu / Angagalulu (Parts of the Human body) Manava Sambhandhada da padhagalulu (Terms Relating to Human Relationship)

Manavana Bhavanegalige sambandhisida Padagalulu (Words Relating to Human's feelings and Emotions)

Vaasada stalaLakke sambhandhisidanthaha padhagalulu (Words Relating to place of leaving)

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit V

Kannada akshara maale (Kannada alphabets and their practices with pronunciations)

swara aksharagaLu –vyanjanaksharagaLu- gunitaksharagaLu, tantragnana mattu Aadhalita padagaLu-Technical and administrative worlds in Kannada

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Text Book:

1. Dr. L. Thimmesha, Prof. Keshava murthy, 'BaLake kannada' prasangaa, VTU,2020.

Reference Book:

1. Smt. Kanya Kumari.S –'Kannada Kali ' Kinnari publications' First edition, Bengaluru,2022
2. Lingadevaru Halemane – 'Kannada Kali', Prasangaa kannada University Hampi, 6th Edition. 2019

Course out comes (COs):

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

1. Develop vocabulary (PO-10)
2. Identify the basic Kannada language skill (PO-10)
3. Develop listening & speaking skill in Kannada language. (PO-6, PO-12)
4. Enrich language skill. (PO-12)
5. Apply Kannada language skill for various purpose (PO-12)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the Two Internal Test Two will be Taken for 30 Marks		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ಕನ್ನಡ ಮನಸು	
Course Code: HS391M	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Program: B.E(Common to all the Branches)	Semester: IV
Course Coordinator: Mrs. Kanya Kumari.S	

ಘಟಕ – 1 (Unit I)

ಲೇಖನಗಳು (Articles)– ಕಾವ್ಯಭಾಗ (poetry)

ಕನ್ನಡ ಭಾಷೆ ನಾಡು – ನುಡಿ

ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ

ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ

ವಚನಗಳು–ಅಕ್ಕಮಹಾದೇವಿ–ಬಸವಣ್ಣ–ಅಲ್ಲಮಪ್ರಭು

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

ಘಟಕ – 2 (Unit II)

ಕೀರ್ತನೆ ಮತ್ತು ತತ್ವ ಪದಗಳು

ಪುರಂದರ ದಾಸರು ಮತ್ತು ಕನಕದಾಸರ ಪದಗಳು

ಶಿಶುನಾಳ ಶರೀಫರು ಮಹಾಂತ ಶಿವಯೋಗಿಗಳ ಪದಗಳು

ಜನಪದ ಗೀತೆ

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

ಘಟಕ – 3 (Unit III)

ಆಧುನಿಕ ಕಾವ್ಯಗಳು

ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ

ಕುರುಡು ಕಾಂಚಾಣ

ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು

Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

ಘಟಕ –4 (Unit IV)

ತಾಂತ್ರಿಕ ಧಾರ್ಮಿಕರು(ವ್ಯಕ್ತಿ ಪರಿಚಯ) ಕಥೆ–ಪ್ರವಾಸ ಕಥನ

ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ– ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ.ಎನ್.ಮೂರ್ತಿರಾಯರು

ಯುಗಾದಿ –ವಸುಧೇಂದ್ರ

ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ -ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

ಘಟಕ- ೫ (Unit V)

ಕರಕುಶಲ ಕಲೆಗಳು -ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನ (technical science)

ಕರಕುಶಲ ಕಲೆಗಳು -ಮತ್ತು ಪರಂಪರೆ ವಿಜ್ಞಾನ- ಕರಿಗೌಡ ಬೇಚನ ಹಳ್ಳಿ

ಕಂಫ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ-

ಕೆ'ಮತ್ತು ಬ ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು .ಕಂಫ್ಯೂಟರ್ ಮುಖಾಂತರ ಕನ್ನಡ ಟೈಪಿಂಗ್
ತಾಂತ್ರಿಕ ಪದಕೋಶ ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

ಪಠ್ಯ ಪುಸ್ತಕ (text book):

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ'

ಸಂಪಾದಕರು : ಡಾ.ಹಿ.ಚಿ, ಬೋರಲಿಂಗಯ್ಯ -ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳು, ಕನ್ನಡ

ವಿಶ್ವವಿದ್ಯಾಲಯ ,ಹಂಪಿ,ಪ್ರಸಾರಂಗ ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ,ಬೆಳಗಾವಿ,ಪ್ರಥಮ
ಮುದ್ರಣ-2020

ಪೂರಕ ಪಠ್ಯ (reference book)

ಕನ್ನಡ ಮನಸು, ಪ್ರಸಾರಂಗ - ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ-ಹಂಪಿ,ಆರನೇಮುದ್ರಣ 2016

ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು-ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು (PO-6)
- ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣ, ಭಾಷಾರಚನೆ ಯ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು(PO-10)
- ಕನ್ನಡ ಭಾಷಾಬರಹದಲ್ಲಿ ಕಂಡು ಬರುವ ದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ(PO10)
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಹಾಗೂ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು(PO-12)
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ,ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು. (PO-12)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
Internal test-1	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the Two Internal Test Two will be Taken for 30 Marks		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - III

Course Code: AEC310	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

PHYSICAL EDUCATION

Course Code: PE83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Kiran Kumar H K	

Course Learning Objectives:

1. To introduce students to the importance of physical fitness for success in any career.
2. To instill in them concepts of team spirit and team building
3. To develop positive thinking, goal setting and decision-making abilities under duress.
4. To harness values and skills like leadership, communication and sacrifice.
5. To inculcate in students, the ability to handle success and failures with equanimity.

Selection Process: A Student shall select any one of the following Sports based on his/her interest and the facility available. The details **of Sports Facilities available (both indoor and outdoor) at institute campus** are as below:

Outdoor Games		Indoor Games		Athletics	
Games	No. of Students	Games	No. of Students	Events	No. of Students
Volleyball	12 x 4 = 48	Badminton	30	Sprint - 100mt, 200mt, 400mt	60
Basketball	12 x 4 = 48	Table Tennis	30	Middle distance running – 800mt, 1,500mt	
Kabaddi	12 x 4 = 48	Chess	30	Long distance running – 5,000mt, 10,000mt	
Kho Kho	12 x 4 = 48	Weight Training [Gym]	35	Jumping Events – Long Jump Triple Jump High Jump	30
Throw ball	12 x 4 = 48			Throwing Events Shot Put Discuss Javelin	30
Football	16 x 4 = 64	Note: Students should bring their own sports attires			
Hockey	16 x 4 = 64				
Cricket	16 x 4 = 64				

Contact Sessions: A student shall abide by the following during the sessions scheduled in the semester.

Session 1

Fundamentals of Physical Education, value addition to personality through fitness education, discipline and team building activities, Orientation towards particular sports and skill training

Session 2

Formation of teams based on student's orientation and preference. Team practice and skill enhancement.

Session 3

Conduction of matches in all sporting events registered by Students. Evaluation of each student shall be based on their performance either in team or individual. The student representing the Institute at University/State/National/International Level will be awarded additional marks during evaluation.

Course Outcomes (COs):

1. Develop interest and skill in playing particular sports.
2. Understand the process of organizing sporting events.
3. Appreciate the role of fitness for a better lifestyle.
4. Derive lessons from sports activities for effective planning and discipline in Life.
5. Analyze situations and optimize end results.

Course Assessment & Evaluation:

1. A committee consisting of Sports Director and Coaches of respective Sports will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation process will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE.

YOGA	
Course Code: YO83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Hari Chandra B P & Dr. Parimala P	

Course Learning Objectives:

1. To introduce to the students, the fundamental theoretical aspects of yoga.
2. To inculcate in students a habit of practicing yoga.
3. To be able to demonstrate basic yoga asanas.
4. To be able to practice fundamental breathing practices and mudras.
5. To understand the relevance of yoga and research in modern times.

Course Content

Introduction: Definition of yoga, benefits, astangas of yoga, Relevance of yoga and yoga-research in modern times.

Asanas: Kriyathmakachalanas, Suryanamaskar, Superbrain yoga, Vrikshasana, Trikonasana, Veerabhadrasana, Paschimotasana, Purvasthanasana, Bharadwajasana, Amruthasana, Parivruttha Trikonasana, Parsvakonasana, Ustrasana, Padmasana, Jaaanushirshasana, Navasana, Ardachakrasana, Ardhatichakrasana, Jataraparivarthanasana, Sethubandasana, Sarvangasana, Mathyasana, Dhanurasana, Shirshasana.

Pranayamas: Anuloma-Viloma, Suryanuloma, Chandranuloma, Brahmari, Suryanbedhana, Chandrabedhana, Sheetali, Seethkari, Sadantha, bastrika.

Mudras: Chinmudra-Jnanamudra, Praana mudra, panchaprana mudras, panchabhoota mudras, Pruthvi mudra, Shoonya mudra, Surya mudra, Jalodharanashaka mudra, Kundalini mudra, shoonyaavaayu mudra, shakti mudra, sandhi mudra, vajra mudra and garuda mudra.

Course Outcomes (CO's):

At the end of the course, a student will

1. Understand the fundamental and theoretical aspects of yoga.
2. Develop a habit of practicing yoga.
3. Demonstrate basic yoga asanas.
4. Demonstrate fundamental breathing practices.
5. Understand the relevance of yoga and its research in modern times.

Reference books:

1. Light on yoga, B K S Iyengar, Publisher -Thorsons, UK, 2006

2. Light on pranayama, B K S Iyengar, Publisher - Element; First Edition
3. The Essential Yoga Mudras for Healing, Dr. Aasoori K. Rangaraja Iyengar, Saranga Publishing; First Edition 2021

Pedagogy:

Chalk and talk, demonstration, videos, ppt.

Contact Sessions:

There would be one introduction class, and five contact classes in each semester.

The candidates shall practice yoga on a daily basis, or in the worst case on alternate days at their place of residence and maintain a short diary in the format provided by yoga teacher. The same shall be brought to the classes.

Online reference sources:

- Yoga for beginners part 1: <https://www.youtube.com/watch?v=VwPeThpwfWI>
- Yoga for beginners part 2: https://www.youtube.com/watch?v=s_pnJTcOp8A
- Suryanamaskar: <https://www.youtube.com/watch?v=nUdlucNd6go&t=133s>
- Yoga for anxiety and stress: https://www.youtube.com/watch?v=hJbRpHZr_d0
- Common yoga protocol: https://www.youtube.com/watch?v=Av5ib_XRKt4
- Relevance of yoga in modern times:
www.youtube.com/watch?v=HUzBCts7BT0

Course Assessment & Evaluation:

1. A committee consisting of Yoga Instructors will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules, and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation processes will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining it with 50 marks for SEE.

Scheme of SEE

Practical Demonstration	30 marks
Write-up	10 marks
Viva	10 marks
Total	50 marks

NATIONAL SERVICE SCHEME

Course Code: NS83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Puttabore Gowda & Dr. Siddaraju C	

Course Learning Objectives:

1. To introduce students to the importance of national service
2. To harness values and skills like leadership, teamwork and sacrifice.
3. To serve society through educational services and health
4. To work towards rural and local development through technological services
5. To inculcate in students, the ability to handle socially relevant projects.

Students shall involve in activities related to national and regional technical and non-technical services, as listed below.

- Serving society by bringing awareness on education and cleanliness.
- Blood donation camps
- Developing technologies for rural masses.
- Conduction and participation in camps for a social cause.
- Educating towards health and well-being of individuals/society.
- Cultural and educational programs for society.
- Contributing towards the improvement of civil services and bringing certain shortcomings to the notice of higher authorities for suitable remedial actions.
- Contribution towards traffic management and other public services.
- Clean up and development of water sources around public places.
- Services during a disaster or other needy situations.
- Camps for the rejuvenation of lakes and water bodies.
- Serving nature and agriculture.
- Awareness programs on health and food adulteration.
- Presenting papers/talks in various fora on the above topics.
- Developing technologies for rural masses beyond academic requirements.
- Plantation programs.
- Conducting programs for self-sustainability, and human and national development.
- Contribution towards orphans and challenged individuals through well-recognized organizations.
- Carrying out designated activities in villages.

- Development and implementation of strategies for solid waste, E-waste etc.
- Education towards pollution control and traffic management.
- Production of documentaries and short films/videos for motivating people on any of the above causes.

Course Outcomes (CO's):

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

1. Understand the importance of national service.
2. Gain skills like leadership and teamwork.
3. Volunteer towards educational services and health.
4. Contribute to rural and local development through technical services.
5. Comprehend socially relevant projects

Contact Sessions:

The students shall attend the review and contact sessions as scheduled by the course coordinator.

Course Assessment & Evaluation:

1. The candidates shall maintain a record of activities in a Diary, and get them endorsed during the contact sessions at least 3 times in a semester.
2. A detailed project report should be submitted during the last fortnight of the semester
3. Evaluation will be done during each semester based on the nature of the contribution.
4. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE

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/>
<https://nptel.ac.in/courses/111/104/111104144/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>

Unit II

Integral Calculus: Introduction, Reduction formula, Reduction formula for $\int \sin^n x \, dx$, $\int \cos^n x \, dx$ and $\int \sin^n x \cos^m x \, dx$. Evaluation of double and triple integrals.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
<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.
2. Apply the concept of reduction formula to determine the length, area, volume of revolution of an arc of the curve.
3. Solve the problems related to velocity and acceleration.
4. Apply vector differentiation to identify solenoidal and irrotational vectors.
5. Apply the concept of various methods to solve first order first degree differential equations.

IV SEMESTER

NUMERICAL TECHNIQUES AND PROBABILITY MODELS	
Course Code: IS41	Credits: 2:1:0
Pre – requisites: Calculus and Basic Probability	Contact Hours: 28L+14T
Course Coordinator: Dr. Govindaraju M V, Dr. R. Suresh Babu	

Course Content

Unit I

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange’s interpolation formula and Newton’s divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson’s $1/3^{\text{rd}}$ rule and Simpson’s $3/8^{\text{th}}$ rule.

- 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/111/106/111106101/>
- 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

Statistics: Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves, Correlation, Regression and Multiple Regression.

Discrete 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 III

Continuous 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 IV

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), when

$\lambda_n = \lambda$ and $\mu_n = \mu$ ($\lambda < \mu$), Performance measures of the model, Single server Poisson queuing model with finite capacity (M/M/S : N/FIFO), Performance measures of the model, Multiple server Poisson queuing model with infinite capacity (M/M/S : ∞ /FIFO), when $\lambda_n = \lambda$ for all n , ($\lambda < S\mu$), 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 V

Sampling and Statistical Inference: Sampling distributions, Concepts of standard error and confidence interval, Central Limit Theorem, Type I and Type II errors, Level of significance, One tailed and two tailed tests, Z-test: for single mean, for single proportion, for difference between means, Student's t –test: for single mean, for difference between two means, F – test: for equality of two variances, Chi-square test: for goodness of fit, 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/>

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.

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. Find functional values, derivatives, areas and volumes numerically from a given data. (PO1, PO2, PSO2)
2. Learn to fit a least squares curve to the given data and analyze the given random data and their probability distributions. (PO1, PO2, PSO2)
3. Find parameters of Continuous Probability distributions and Calculate the marginal and conditional distributions of bivariate random variables. (PO1, PO2, PSO2)
4. Use Markov chain in prediction of future events and in queuing models. (PO1, PO2, PSO2)
5. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1,2 & PSO-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
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPERATING SYSTEMS

Course Code: IS42	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 28L+14P
Course Coordinator: Dr. Geetha V	

Course Content

Unit I

Operating Systems Overview: Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments. Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, Process Scheduling: Basic Concepts, Scheduling Criteria -Scheduling Algorithms

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105214>
- Impartus recording: <https://a.impartus.com/ilc/#/course/148805/703>

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105214>
- Impartus recording: <https://a.impartus.com/ilc/#/course/148805/703>

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.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105214>
- Impartus recording: <https://a.impartus.com/ilc/#/course/148805/703>

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.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105214>
- Impartus recording: <https://a.impartus.com/ilc/#/course/148805/703>

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105214>
- Impartus recording: <https://a.impartus.com/ilc/#/course/148805/703>

Programs on the following APIs

- APIs for handling Files, Process and IPC
- Process scheduling

Text Books:

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

Course Outcomes (COs):

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

1. Understand the structure and functionality of 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)

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		
GATE based Aptitude test	10	CO1, CO2, CO3
Programming Assignment	10	CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

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. Megha. P. Arakeri	

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, practice exercises
- Links: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/59981/295>

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, practice exercises
- Links: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/59981/295>

Unit III

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

- Pedagogy/Course delivery tools Chalk and talk, PowerPoint Presentation, practice exercises
- Links: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/59981/295>

Unit IV

Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Transform and Conquer: Balanced Search Trees, Heaps and Heapsort.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, practice exercises
- Links: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/59981/295>

Unit V

Limitations of Algorithm Power: P, NP and NP-Complete Problems. Coping with the Limitations of Algorithm Power: Backtracking (n-Queens Problem) Branch-and-Bound (Travelling Salesman Problem).

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, practice exercises
- Links: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- Impartus recording: <https://a.impartus.com/ilc/#/course/59981/295>

Text Books:

1. Anany Levitin, "Introduction to The Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2007.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Introduction to Algorithms, 2nd Edition, PHI, 2006.
2. Computer Algorithms, Horowitz E. Sahni S, Rajasekaran S, Galgotia Publications, 2001.

Course Outcomes (COs):

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

1. Describe the fundamentals of algorithms, problem types and standard algorithm design techniques. Properties (PO1, PSO1)
2. Develop algorithms using standard algorithm design techniques to solve computational problems. (PO1, PO2, PO3, PO9, PO10, PO12, PSO1)
3. Analyze the efficiency of algorithms through mathematical analysis. (PO1, PO2, PO4, PO9, PO10, PO12, PSO1)
4. Apply algorithms and design techniques to solve computational problems (PO1, PO2, PO3, PO4, PO9, PO10, PO12, PSO1)
5. Understand the limitations of algorithm's in solving computational problems. (PO1, PSO1)

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		
Programming Assignment	20	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MICROCONTROLLERS	
Course Code: IS44	Credits: 3:0:0
Pre – requisites: Computer Organization and Architecture	Contact Hours: 42L
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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/108105102>
- Impartus recording: <https://a.impartus.com/ilc/#/course/1259590/1112>

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/108105102>
- Impartus recording: <https://a.impartus.com/ilc/#/course/1259590/1112>

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.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Video based learning

- Links: <https://nptel.ac.in/courses/108105102>
- Impartus recording: <https://a.impartus.com/ilc/#/course/1259590/1112>

Unit IV

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

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Video based learning
- Links: <https://nptel.ac.in/courses/108105102>
- Impartus recording: <https://a.impartus.com/ilc/#/course/1259590/1112>

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.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/108105102>
- Impartus recording: <https://a.impartus.com/ilc/#/course/1259590/1112>

Text Books:

1. Andrew Sloss, Dominic Symes, Chris Wright, “ARM System Developer's Guide - Designing and Optimizing System Software”, Elsevier Publication 2012.
2. Lyla B Das, “Architecture, Programming, and Interfacing of Low-power Processors – ARM7, Cortex-M”, Cengage Learning India Pvt. Ltd. 2017.

Reference Books:

1. Kris Schindler, “Introduction to Microprocessor Based Systems using the ARM Processor”, Second Edition, Pearson Education, 2013.

Course Outcomes (COs):

At the end of the course, students 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)

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

DATABASE MANAGEMENT SYSTEMS

Course Code: IS45	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Lincy Mathews	

Course Content

Unit I

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106105175>
- Impartus recording: <https://a.impartus.com/ilc/#/course/132216/636>

Unit II

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

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106105175>
- Impartus recording: <https://a.impartus.com/ilc/#/course/132216/636>

Unit III

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

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/106105175>
- Impartus recording: <https://a.impartus.com/ilc/#/course/132216/636>

Unit IV

Complex SQL Queries. Insert, Delete and Update statements in SQL.

Introduction to Transaction Processing, Transaction and System Concepts, Desirable properties of Transactions, Transaction Support in SQL.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/106105175>
- Impartus recording: <https://a.impartus.com/ilc/#/course/132216/636>

Unit V

Two-phase Locking Techniques for Concurrency Control, Recovery techniques based on Deferred Update, Recovery techniques based on Immediate Update.

Introduction to NoSQL, characteristic and types of NoSQL database

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/106105175>
- Impartus recording: <https://a.impartus.com/ilc/#/course/132216/636>

Text Books:

1. Ramez Elmasri and Shamkant B.Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007.
2. Benjamin Rosenzweig, Elena Silvestrova Rakhimov: Oracle PL/SQL by Example, 4th Edition, 2010.

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”

Course Outcomes (COs):

At the end of the course, students 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)

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		
GATE based aptitude test	10	CO2, CO3, CO4
Programming Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Course Code: ISL46	Credits: 0:0:1
Pre – requisites: Fundamentals of Computing & Data Structure	Contact Hours: 14P
Course Coordinator: Dr. Megha. P. Arakeri	

Course Content

1. The goods packages in a supermarket are assigned an integer label. Write a C program to sort the set of goods packages based on label identifier using Bubble Sort/Selection Sort and determine the time required to sort. Plot a graph of number of label identifiers versus time taken.
2. A library maintains details of N books where every book is assigned a unique ISBN. Develop a program in C to sort the books based on ISBN using merge sort technique. Determine the time required to sort. Repeat the experiment for different values of N and plot a graph of the time taken versus N.
3. Consider a list of ‘n’ files numbered using ID’s. Write a C program to sort files based on its ID using Quick sort. Determine the time required sort the files. Plot a graph of number of IDs versus time taken.
4. Consider a network of ‘n’ systems represented as a Graph. Write a ‘C’ program to find the transitive closure of such a network using Warshall’s algorithm. Give the trace of this algorithm.
5. Suppose in a network of cities, you are interested in finding shortest paths between all cities. Design a ‘C’ program to implement this using Floyd’s algorithm. Give the trace of this algorithm.
6. Design and develop a program in C to print all the nodes reachable from a given starting node in a digraph by using BFS method. Give the trace of this algorithm.
7. A university is looking for engineering graduates, they need to sort the candidate’s resume based on their ranking. Write a C program to sort the resumes by using heap sort. Determine the time required to sort the elements. Plot a graph of number of elements versus time taken. Specify the time efficiency class of this algorithm.
8. Consider the problem of searching for genes in DNA sequences. A DNA sequence is represented by a text using alphabets [A, C, G, T]. Design a ‘C’ program to locate a pattern in a given DNA sequence using Horspool’s algorithm. Give the trace of this algorithm.

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

Text Books:

1. Anany Levitin, "Introduction to The Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2007.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Introduction to Algorithms, 2ndEdition, PHI, 2006.
2. Computer Algorithms, Horowitz E. Sahni S, Rajasekaran S, Galgotia Publications

Course Outcomes (COs):

At the end of the course, students 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)

MICROCONTROLLER LAB	
Course Code: ISL47	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Mr. Prashanth Kambli	

Course Content

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.

Text Books:

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

Course Outcomes (COs):

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

1. Develop assembly code using ARM instructions for a given set of problems. (PO1, PO2, PO3, PO5, PO9, PO10, PSO1, PSO2)
2. Develop assembly code to interface the same on a hardware component. (PO1, PO2, PO3, PO5, PO9, PO10, PSO1, PSO2)
3. Interpret the results and produce the substantial document. (PO2, PO3, PO4, PO9, PO10, PSO1)

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: ISL48	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. Lincy Meera Mathews	

Course Content

Exercise-I

Consider an Employee with a social security number (SSN) working on multiple projects with definite hours for each. Each Employee belongs to a Department. Each project is associated with some domain areas such as Database, Cloud and so on. Each Employee will be assigned to some project. Assume the attributes for Employee and Project relations.

- a) Mention the constraints neatly.
- b) Design the ER diagram for the problem statement
- c) State the schema diagram for the ER diagram.
- d) Create the tables, insert suitable tuples and perform the following operations in SQL
 1. Obtain the details of employees assigned to “Database” project.
 2. Find the number of employees working in each department with department details.
 3. Update the Project details of Employee bearing SSN = #SSN to ProjectNo = #Project_No and display the same.
- e) Create the table, insert suitable tuples and perform the following operations using MongoDB
 1. List all the employees of Department named #Dept_name.
 2. Name the employees working on Project Number :#Project_No
- f) Write a program that gives all employees in Department #number a 15% pay increase. Display a message displaying how many employees were awarded the increase.

Exercise-II

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:
 1. Obtain the details of parts supplied by supplier #SNAME.
 2. Obtain the Names of suppliers who supply #PNAME.
 3. Delete the parts which are in #PCOLOR.
- e) Create the table, insert suitable tuples and perform the following operations using MongoDB
 1. Update the details of parts for a given part identifier: #PID.
 2. Display all suppliers who supply the part with part identifier: #PID.
- f) Write a PL/SQL program to copy the contents of the Shipment table to another table for maintaining records for specific part number.

Exercise-III

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

- a) Mention the constraints neatly.
- b) Design the ER diagram for the problem statement
- c) State the schema diagram for the ER diagram.
- d) Create the tables, insert suitable tuples and perform the following operations in SQL:
 1. Obtain the details of the boats reserved by '#Sailor_Name'.
 2. Retrieve the BID of the boats reserved necessarily by all the sailors.
 3. Find the number of boats reserved by each sailor. Display the Sailor_Name along with the number of boats reserved.
- e) Create the table, insert suitable tuples and perform the following operations using MongoDB.
 1. Obtain the number of boats obtained by sailor :#Sailor_Name
 2. Retrieve boats of color :”#color”
- f) Write a PL/SQL program to check whether a given number is prime or not.

Exercise-IV

Consider the Banking database – CUSTOMER, BRANCH, ACCOUNT and TRANSACTION. An account can be a savings account or a current account.

Customer can have both types of accounts. The transactions can be a deposit or a withdrawal. Mention the constraints neatly.

- a) Design the ER diagram for the problem statement
- b) State the schema diagram for the ER diagram.
- c) Create the above tables, insert suitable tuples and perform the following operations in SQL:
 1. Obtain the details of customers who have both Savings and Current Account.
 2. Retrieve the details of branches and the number of accounts in each branch.
 3. Obtain the details of customers who have performed at least 3 transactions.
 4. List the details of branches where the number of accounts is less than the average number of accounts in all branches.
- d) Create the table, insert suitable tuples and perform the following operations using MongoDB
 1. Find the branch name for a given Branch_ID.
 2. List the total number of accounts for each customer.
- e) Using cursors demonstrate the process of copying the contents of one table to a new table.

Exercise-V

Consider the Book Lending system from the library- BOOKS, STUDENT, BORROWS. The students are allowed to borrow any number of books on a given date from the library. The details of the book should include ISBN, Title of the Book, author, and publisher. All students need not compulsorily borrow books.

- a) Mention the constraints neatly.
- b) Design the ER diagram for the problem statement
- c) State the schema diagram for the ER diagram.
- d) Create the above tables, insert suitable tuples and perform the following operations in SQL:
 1. Obtain the names of the student who has borrowed either book bearing ISBN '123' or ISBN '124'.
 2. Obtain the Names of female students who have borrowed "Database" books.
 3. Find the number of books borrowed by each student. Display the student details along with the number of books.
- e) Create the table, insert suitable tuples and perform the following operations using MongoDB
 1. Obtain the book details authored by "author_name".
 2. Obtain the Names of students who have borrowed "Database" books.

- f) Write a PL/SQL procedure to print the first 8 Fibonacci numbers and a program to call the same.

Text Books:

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

Course Outcomes (COs):

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

1. Develop relational database schema by using data definition language utilities.(PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)
2. Develop solutions to the broad range of query and data update problems using SQL/MongoDB, (PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)
3. Implement programmatic components for a database using PLSQL (PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO3)
4. Analyze the results and produce substantial written documentation (PO1, PO2, PO4, PO9, PO10, PSO1)

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	
Course Code: HS492	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Mrs. Kanya Kumari S	

Course Content

Unit I

Introduction to the Constitution of India

Meaning and Significances of the Constitution, making of the Indian Constitution and its salient features, Preamble of the Constitution, Fundamental Rights and relevant cases.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit II

Relevance of Directive Principles of State Policy -part-IV

Fundamental Duties & their significance. Special constitutional provisions for the betterment of Women, children and backward classes in India.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit III

Union executive and State executive

President of India, Vice President, Prime Minister & Council of Ministers. The Union Legislature, Compositions & the functions of Parliament and the Supreme court of India -composition & Jurisdictions

State executive-Governor, Chief Minister& council of Ministers, State legislature-composition & functions of legislative assembly& legislative council and State Judiciary.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit IV

Local self-Governments, Emergency provisions, Electoral process & Major Constitutional Amendments

Local Self Governments- Panchayath Raj system, Emergency provisions, election commission of India & Electoral process, Amendment procedure and Major Constitutional amendments.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Unit V

Human Rights and Professional Ethics

Human Rights - meaning and significances of Human Rights. Universal Declaration of Human Rights (UDHR) protection of Human Rights in Indian Context. Scope and Aim of Ethics. Responsibility of Engineers, impediment to Responsibility.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

Text Books:

1. A Primer on Constitution of India & Professional ethics, VTU Publication-2007.

Reference Books:

1. Durga Das Basu,- ' Introduction to Constitution of India' - 19th/20th edition 2001
2. M.V.Pylee.- ' An Introduction to Constitution of India, 4th edition, 2008
3. Dr. K. R. Phaneesh,- 'Constitution of India & Professional ethics' –Sudha publication, Tenth revised edition 2018.

Course outcomes (COs):

At the end of the course students will be able to

1. Identify the fundamental principles of Indian constitution. (PO-12)
2. Examine various provisions of the Directive principles of state policies and fundamental duties. (PO-6, PO-12)
3. Understand the powers & functions of executive, Legislature and judicial system at the center and state level. (PO-6, PO-12)
4. Identify the role of government. (PO-12)
5. Understand about basic Human rights in India (PO-6, PO-8, PO-12)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - IV

Course Code: AEC410	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

ADDITIONAL MATHEMATICS - II

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

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
- Online tools: Use of open source software’s to demonstrate methods and solve problems on interpolation
- 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
- Online tools: Use of open source software’s to demonstrate methods and solve problems on numerical differentiation and integration.
- 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/619570/1030>

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/>
<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.
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series.
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems.
4. Find the solution of second and higher order ODEs with constant and variable coefficients.
5. Solve the problems on conditional probability and Baye’s theorem.