



RAMAIAH
Institute of Technology

CURRICULUM

Outcome Based Education
(Academic Year 2022 – 2023)

Computer Science and Engineering
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
and
Computer Science and Engineering
(CYBER SECURITY)

III & IV SEMESTER B.E.
Computer Science and Engineering
(AI & ML)

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

Year of Establishment	2021
Names of the Programme offered	UG: B.E. in Computer Science and Engineering (Artificial Intelligence and Machine Learning)

The Department of Computer Science and Engineering (Artificial Intelligence and Machine Learning) has eminent professor and faculty with the doctorate degree. The faculty has been publishing research papers in refereed journals and in conference proceedings. The department has the state of the art laboratories and class rooms. The department conducts Technical seminars, workshops and hackathons regularly for students. The department encourages the students to conduct and participate in extra-curricular/sports activities. The department conducts courses with more of hands- on sessions and encourages students to take up MOOC based online courses in NPTEL, IIT Bombay, Coursera, Udacity, Udemy and edX.

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 M. S. 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 provide quality education, inculcate professionalism, and enhance problem solving and coding, innovative design skills in Computer Science and Engineering especially in the domain of AI & ML and Cyber Security with a focus to produce professionally competent and socially sensitive engineers capable of working in a global environment.

MISSION OF THE DEPARTMENT

To pursue excellence in Academics, Research and Innovation by:

1. Enabling creative and dynamic learning environments to impart quality technical education through continuously improving curriculum and pedagogy techniques.
2. Collaborating with the industry, academia and society for strengthening design thinking, research, innovation, and entrepreneurship ecosystem.
3. Encouraging extra and co-curricular activities to nurture the leadership qualities with a sense of commitment and accountability and inculcate values and ethics.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

A B.E in Computer Science & Engineering (Artificial Intelligence and Machine Learning) graduates of Ramaiah Institute of Technology:

PEO1: Excel in professional career by acquiring knowledge in basic sciences and Computer Science and Engineering, Artificial Intelligence & Machine Learning principles and contribute to the profession as an excellent employee, or as an entrepreneur.

PEO2: Capable of pursuing higher education and research.

PEO3: Adapt to technological advancements in multidisciplinary environments by engaging in lifelong learning with leadership qualities, professional ethics and soft skills.

PROGRAM OUTCOMES (POs):

The Outcomes of the Bachelor of Engineering in Computer Science & Engineering (Artificial Intelligence and Machine Learning) Programme are as follows:

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 teamwork: 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: Ability to understand and identify problems/opportunities where CSE, AI and ML concepts can be applied and to identify the right AI and ML techniques in such contexts.

PSO2: Ability to perform the data engineering, designing, developing and testing the AI and ML solutions that include both hardware and software.

PSO3: Ability to be aware of technical solutions that are following ethical aspects aligning with social responsibilities both at designing and developmental phases of applications.

SCHEME OF TEACHING III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	CI31	Linear Algebra, Laplace Transforms and Optimization	Mathematics	BSC	2	1	0	3	4
2	CI32	Data Base Management Systems (Integrated)	CSE (AI&ML)	IPCC	2	0	1	3	4
3	CI33	Data Structures	CSE (AI&ML)	PCC	3	0	0	3	3
4	CI34	Computer organization and Architecture	CSE (AI&ML)	PCC	3	0	0	3	3
5	CI35	Discrete Mathematical Structures	CSE (AI&ML)	PCC	2	1	0	3	3
6	CIL36	Data Structures Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
7	CIL37	Object Oriented Programming Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
8	UHV38	Universal Human Values	CSE (AI&ML)	UHV	2	0	0	2	2
9	HS391	Kannada (Kali / Manasu)	Humanities	HSMC	1	0	0	1	1
10	AEC310	Ability Enhancement Course- III	Any Dept	AEC	1	0	0	1	1
Total								21	25
11	PE83	Physical Education	PE	NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VIII semesters. Qualifying is mandatory for the award of the degree.				
	YO83	Yoga	PE						
	NS83	National Service Scheme	NSS						
12	AM31	Additional Mathematics - I *	Mathematics	--	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	CI41	Numerical Techniques and Probability Models	Mathematics	BSC	2	1	0	3	4
2	CI42	Data Communication and Networking (Integrated)	CSE (AI&ML)	IPCC	2	0	1	3	4
3	CI43	Design and Analysis of Algorithms	CSE (AI&ML)	PCC	2	1	0	3	3
4	CI44	Introduction to Artificial Intelligence	CSE (AI&ML)	PCC	3	0	0	3	3
5	CI45	Operating System	CSE (AI&ML)	PCC	3	0	0	3	3
6	CIL46	Embedded Systems Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
7	CIL47	Algorithms Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
8	CIL48	Web Technologies Laboratory	CSE (AI&ML)	PCC	0	0	1	1	2
9	HS492	Constitution of India & Professional Ethics	Humanities	HSMC	1	0	0	1	1
10	AEC410	Ability Enhancement Course – IV	Any Dept	AEC	1	0	0	1	1
11	INT411	Inter/ Intra Institutional Internship	CSE (AI&ML)	INT	0	0	2	2	-
				Total				22	25
12	AM41	Additional Mathematics II *	Mathematics	NCMC	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 AND OPTIMIZATION	
Course Code: CI31	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 Contents

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.

Application of Laplace Transforms: 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 II

Linear Programming: Introduction to Linear Programming Problem (LPP), Formulation of the problem, Graphical method, General, Canonical and standard forms of LPP, Simplex method, Big-M method, Two-phase simplex method and Duality in linear programming.

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

Unit III

Linear Transformation: 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, Power Point Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105035/>
<https://nptel.ac.in/courses/111/102/111102152/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/621524/1030>
<https://a.impartus.com/ilc/#/course/619570/1030>

Unit IV

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>

Suggested Learning Resources

Text Books:

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

Reference Books:

1. Peter V. O'Neil – Advanced Engineering Mathematics – Cengage learning, 7th edition, 2011.
2. Gareth Williams – Linear Algebra with Applications, Jones and Bartlett Press, 9th edition, 2017.
3. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers - 10th edition, 2015.
4. Kanti Swarup, P.K. Gupta and Man Mohan -Operations Research-Sultan Chand & Sons Publishers–2014.

Course Outcomes (COs):

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

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

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz –I	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz-I +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3 CO4, CO5

DATA BASE MANAGEMENT SYSTEMS (INTEGRATED)

Course Code: CI32	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 28L+14P
Course Coordinator: Dr. Sini Anna Alex	

Course Contents

Unit I

Introduction: Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Entity-Relationship Model: Conceptual Database using high level Conceptual data models for Database Design, A Sample Database Application, 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, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105175>
<https://nptel.ac.in/courses/106106220>

Unit II

Relational Database Design Using ER- to-Relational Mapping, Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schema Update Operations, Transactions and Dealing with Constraint violations, Unary Relational operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105175>
<https://nptel.ac.in/courses/106106220>

Unit III

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic structure of SQL Queries, Additional Basic Operations, Null values,

Aggregate Functions, nested Sub queries, Modification of the Database, Join Expressions, Views, Integrity Constraints, SQL Data Types and Schemas.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105175>
<https://nptel.ac.in/courses/106106220>

Unit IV

Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Inference Rules, Equivalence and Minimal Cover, Normal Forms based on Primary Keys, First Normal Form, General Definitions of 2nd and 3rd Normal Forms, Boyce Codd Normal Form, Properties of Relational Decomposition, Algorithms for relational database schema design.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105175>
<https://nptel.ac.in/courses/106106220>

Unit V

Transaction Management: Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels. Concurrency Control: Lock-Based Protocols, Deadlock Handling. Recovery System: Failure Classification, Recovery and Atomicity, Recovery Algorithm.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105175>
<https://nptel.ac.in/courses/106106220>

Suggested Learning Resources

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe: Fundamentals of Database Systems, 7th Edition, Pearson, 2016.
2. Silberschatz, Korth and Sudharshan: Data base System Concepts, 7th Edition, Mc-GrawHill, 2021.

Reference Book:

1. C.J. Date, A. Kannan, S. Swamynatham, An Introduction to Database Systems, 8th Edition, Pearson education, 2009.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Design entity-relationship diagrams to represent simple database applications and convert to Relational model (PO-2, 3, 4, 5, PSO-2)
2. Construct relational algebraic expressions for queries using the concepts of relational database theory (PO-1, 2, 4, PSO-2)
3. Formulate using SQL, solutions to a broad range of query and data update problems (PO-2,3,4,5, PSO-2)
4. Apply Normalization to improve database design (PO-1, 2, PSO-2)
5. Interpret the basic issues of transaction processing, concurrency control and recovery techniques (PO-3,4, 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		
Assignment	10	CO1, CO2, CO3
Course Project	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATA STRUCTURES

Course Code: CI33	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Siddesh G M	

Course Contents

Unit I

Basic Concepts: Pointers and Dynamic Memory Allocation: Introduction, Dynamic Memory Allocation, allocating a Block of Memory: Malloc, allocating a Multiple Blocks of Memory: Calloc, Releasing the Used Space: Free, Altering the size of Block: Realloc, Algorithm Specification, Data Abstraction. Arrays and Structures: Arrays, Dynamically Allocated Arrays, Structures and Unions, Sparse Matrices, Representation of Multidimensional Arrays.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://www.digimat.in/nptel/courses/video/106105151/L17.html>
- <https://www.digimat.in/nptel/courses/video/106105151/L18.html>

Unit II

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Applications of Stacks: Implementing Parentheses Checker, Evaluation of Arithmetic Expressions, Recursion.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106127>
<https://nptel.ac.in/courses/106103069>

Unit III

Queues: Introduction to Queues, Array Representation of Queues, Types of Queues, Circular Queues, Deques, Priority Queues, Multiple Queues, Applications of Queues.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links:
<https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F>
<https://nptel.ac.in/courses/106103069>

Unit IV

Linked Lists: Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Circular Doubly Linked Lists, Linked Representation of Stack, Linked Representation of Queues.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links:
<https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F>
<https://nptel.ac.in/courses/106103069>

Unit V

Trees: Introduction, Types of Trees, creating a Binary Tree from a General Tree, Traversing a Binary Tree, Applications of Trees

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links:
<https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F>
<https://nptel.ac.in/courses/106103069>

Suggested Learning Resources

Text Books:

1. Reema Thareja, Data Structures using C, Second edition, Oxford press, 2014.

Reference Books:

1. Horowitz, Sahani, Anderson, Freed, Fundamentals of Data Structures in C, Second edition, 2014
2. Yedidyah Langsam & Moshe J. Augenstein, Aaron M. Tanenbaum, Data Structures using C, Second Edition, Pearson Education, 2017.

Course Outcomes (COs):

At the end of Course, Student will be able to:

1. Illustrate arrays, pointers and structures with programming solutions for real world problems. (PO-1,2,3,4,5, PSO-1,2)
2. Demonstrate the concepts of Stack, types of queues and its various operations. (PO-1,2,3, PSO-1,2)
3. Describe the concepts of Linked list and its applications. (PO-1,2,3,4,5, PSO-1,2)

4. Demonstrate the concepts of binary trees and perform tree traversal (PO-1,2,3, PSO-2)
5. Apply appropriate data structures to solve real-world problems efficiently. (PO-1,2,3,4,5, PSO-2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 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	10	CO1, CO2, CO3
Case Study	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code: CI34	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Mohana Kumar S	

Course Contents

Unit I

Fundamentals of Digital Logic and Basic Structure of Computers: Boolean Algebra, Logic Gates, Combinational Circuits: Adders, Mux, De-Mux, Sequential Circuits: Flip-Flops (SR, JK & D), Counters: synchronous and asynchronous Counter, Traditional Classes of Computing Applications and their Characteristics, layers of software, From a High-Level Language to the Language of Hardware, the organization of a computer, Technologies for Building Processors and Memory, performance of computers, the power wall, Amdahl's Law.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105163>
<https://nptel.ac.in/courses/108105113>

Unit II

Instructions: Instruction set, Addressing Modes, Assembly Language, Representing Instructions in the Computer, Logical Operations, Instructions for Making Decisions, Supporting Procedures in Computer Hardware, Translating and Starting a Program, **Arithmetic:** Addition and Subtraction, Design of Fast Adders, Multiplication, First version of the multiplication hardware, division, A Division Algorithm and Hardware, Floating Point.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105163>

Unit III

Large and Fast: Exploiting Memory Hierarchy: Memory Technologies, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, The Basics of Caches, Measuring and Improving Cache Performance, Virtual memory, Dependable Memory Hierarchy.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105163>

Unit IV

Processor, Graphics and Computing GPUs: Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors, GPU system architectures, Programming GPUs, introduction to the CUDA Paradigm, Multiprocessor Architecture, Multicore processor.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105220>

Unit V

Parallel Processors from Client to Cloud: The Difficulty of Creating Parallel Processing Programs, SISD, MIMD, SIMD, SPMD, and Vector, Hardware Multithreading, Multicore and Other Shared Memory Multiprocessors, Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers, and Other Message Passing Multiprocessors, Introduction to Multiprocessor Network Topologies.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://www.geeksforgeeks.org/computer-architecture-flynns-taxonomy/>

Suggested Learning Resources

Text Books:

1. Computer Organization and Design, David A. Patterson, John L. Hennessy: M.K Publishers, 4th edition and 5th edition, 2014
2. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, TM
3. Digital design. Mano, M. Morris. Pearson Education, 6th Edition 2002.

Reference Books:

1. Computer Organization & Architecture, William Stallings, 7th Edition, PHI, 2006

Course Outcomes (COs):

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

1. Understand the general concepts in digital logic design, including logic elements, and their use in combinational and sequential logic circuit design and Basic Structure of Computers. (PO-1,2,3, PSO-1)
2. Describe addressing modes, instruction formats and program control statements. (PO-1,2,3, PSO-1)
3. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. (PO-1,2,3, PSO-1)
4. Understand computer arithmetic formulate and solve problems, understand the performance requirements of systems. (PO-1,2,3, PSO-1)
5. Interpret performance of different pipelined processors. (PO-1,2,3, 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		
Seminar	10	CO1, CO2, CO3
Simulation Tool Based Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DISCRETE MATHEMATICAL STRUCTURES

Course Code: CI35	Credits: 2:1:0
Pre – requisites: Basic Mathematics	Contact Hours: 28L+14T
Course Coordinator: Dr. Govindaraju M V and Dr. S H C V Subba Bhatta	

Course Contents

Unit I

Fundamentals of Logic and Set Theory: Introduction to Logic. Propositional Logic, Truth Tables, and Quantifiers, Mathematical Proofs. Infinite Sets, Well-Ordering. Countable and Uncountable Sets, Cantor's Diagonalization. Mathematical Induction - Weak and Strong Induction.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106183>
<https://nptel.ac.in/courses/106108227>

Unit II

Relations and Functions: Relations, Equivalence Relations. Functions, Bijections. Binary Relations. Boolean Algebra, Posets and Lattices, Hasse Diagrams.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106183>
<https://nptel.ac.in/courses/106108227>

Unit III

Recurrence Relations: Counting, Sum and Product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence Relations - Methods of solutions. Generating Functions. Permutations and Counting.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106183>
<https://nptel.ac.in/courses/106108227>

Unit IV

Graph Theory: Introduction to Graph Theory- Definitions, Sub Graphs, Complements, and Graph Isomorphism, Euler's Trails and Circuits, Hamilton Paths and Cycles. Planar Graphs, Euler's Theorem, Graph Coloring.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106183>
<https://nptel.ac.in/courses/106108227>

Unit V

Abstract Algebra: Binary Operations, Semi Groups, Monoid, Submonoid Groups, Subgroups, Isomorphism, Homomorphism, Euler's phi function, Fermat's Little theorem.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106183>
<https://nptel.ac.in/courses/106108227>

Suggested Learning Resources

Text Books:

1. Kenneth Rossen, Discrete Mathematics and its Application, 7th Edition, McGraw-Hill, 2011.
2. Thomas Koshy: Discrete Mathematics with Applications. 1st Edition, Elsevier Science, 2012.
3. B. Kolman, R.C. Busby, S.C. Ross, Discrete Mathematical Structures, Pearson Education India; 6th edition, 2015.

Reference Books:

1. R.P. Grimaldi, B.V. Ramana, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson, 2008.
2. Elements of Discrete Mathematics, C. L Liu, McGraw-Hill Inc, 1985. Applied Combinatorics, Alan Tucker, 2007.
3. Huth M and Ryan M, "Logic in Computer Science: Modeling and Reasoning About Systems", Cambridge University Press. 2005.
4. Douglas B. West, Introduction to Graph Theory, Second Edition, Prentice-Hall.

Course Outcomes (COs):

At the end of the course, students should be able to:

1. Write an argument using logical notation and determine if the argument is valid or invalid. (PO-1,2,4, PSO-2,3)
2. Demonstrate an understanding of relations and be able to determine their properties. (PO-1,2,4,5,10, PSO-2)
3. To formulate problems and solve them using recurrence relations. (PO-1,4,5,10, PSO-2)
4. Demonstrate knowledge of fundamental concepts in graphs using various modelling techniques. (PO-1,2, 5,10, PSO-2)
5. Demonstrate knowledge of homomorphism and isomorphism. (PO-1, 2, 5, 10, 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

DATA STRUCTURES LABORATORY

Course Code: CIL36

Credits: 0:0:1

Pre – requisites: Nil

Contact Hours: 14P

Course Coordinator: Dr. Siddesh G M

Sl. No.	List of Programs
1.	<p>Design, Develop and Implement a menu driven Program in C for the following array operations.</p> <ul style="list-style-type: none">a) Creating an array of N Integer Elementsb) Display of array Elements with Suitable Headingsc) Inserting an Element (ELEM) at a given valid Position (POS)d) Deleting an Element at a given valid Position(POS)e) Exit. <p>Support the program with functions for each of the above operations.</p>
2.	<p>Define an EMPLOYEE structure with members Emp_name, Emp-id, Dept-name and Salary. Read and display data of N employees. Employees may belong to different departments. Write a function to find total salary of employees of a specified department. Use the concept of pointer to structure and allocate the memory dynamically to EMPLOYEE instances</p>
3.	<p>STACK of Integers (Array Implementation of Stack with maximum size MAX)</p> <ul style="list-style-type: none">a) Push an Element on to Stackb) Pop an Element from Stackc) Demonstrate how Stack can be used to check Palindromed) Demonstrate Overflow and Underflow situations on Stacke) Display the status of Stackf) Exit <p>Support the program with appropriate functions for each of the above operations</p>
4.	<p>Write a C 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</p>
5.	<p>Write a C 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 /.</p>

6.	Write recursive functions for the following and demonstrate their use. a) Binary Search b) Tower of Hanoi problem.
7.	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 appropriate data structure. Program should have options to add and remove the phone calls in appropriate order for their service.
8.	Write a C program to simulate the working of a circular Queue of integers. Represent circular queue element as a structure and use array of structures as your implementation method. Start and end of the circular queue must be identified by an empty array element.
9.	Write a program to create a singly linked list that maintains a list of names in alphabetical order. Implement the following operations on the list. a. Insert a new name b. Delete a specified name
10.	Write a C program to maintain a stack of integers using linked implementation method.
11.	Write a C program to support the following operations on a doubly linked list. a) Insert a new node to the left of the node whose key value is read as an input. b) Delete a node with given data, if it is found otherwise display appropriate error message.
12.	Write a C program a) To construct a binary tree of integers. b) To traverse the tree using inorder, preorder and postorder traversal methods

Suggested Learning Resources

Reference Books:

1. Data Structures using C, Reema Thareja, Second edition, Oxford press, 2014.
2. Fundamentals of Data Structures in C, Horowitz, Sahani, Anderson, Freed, Second edition, 2014
3. Data Structures using C, Yedidyah Langsam & Moshe J. Augenstein, Aaron M. Tanenbaum Second Edition, Pearson Education, 2017.

Course Outcomes (COs):

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

1. Simulate stack and queue operations and implement its applications. (PO-1,2,3,4,5, PSO-2,3)
2. Develop C programs on linked list and its variations. (PO-1,2,3,4,5, PSO-2,3)
3. Construct C programs on Binary tree and its applications. (PO-1,2,3,4,5, PSO-2,3)

Course Assessment and Evaluation:

Parameter	Marks
CIE Test	20
Lab Record Writing + Viva+ program execution	30
Total	50
Final Exam will be conducted for 50 marks (SEE)	

OBJECT ORIENTED PROGRAMMING LABORATORY

Course Code: CIL37	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Akshata G C	

COURSE CONTENTS

1. Introduction to Object-Oriented Programming
2. Primitive Data type and Operators
3. Control Statements and Arrays
4. Classes, objects, static variables
5. Constructors and deconstructs
6. Dynamic Memory Allocation
7. Polymorphism
8. Inheritance
9. Templates
10. Exception handling
11. File Handling

***Note: Practical sessions will be based on the contents.**

Suggested Learning Resources

Reference Books:

1. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH, 2005.
2. C++ Primer, Stanley B. Lippman, Josee Lajoie, Barbara E. Moo, 4th Edition, Addison Wesley, 2005.
3. Object-Oriented Programming with C++, Sourav Sahay, Oxford University Press, 2006.

Course Outcomes (COs):

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

1. Develop C++ programs using object-oriented concepts and dynamic memory allocation. (PO-2,3,5, PSO-2,3)
2. Apply the knowledge of compile time and runtime polymorphism. (PO-2,3,5, PSO-2,3)
3. Develop C++ programs using inheritance, templates and exception handling for the given problem. (PO-2,3,5, PSO-2,3)

Course Assessment and Evaluation:

Parameter	Marks
CIE Test	20
Lab Record Writing + Viva+ program execution	30
Total	50
Final Exam will be conducted for 50 marks (SEE)	

UNIVERSAL HUMAN VALUES

Course Code: UHV38

Credits: 2:0:0

Pre – requisites: Nil

Contact Hours: 28L

Course Coordinator: Dr. Mohana Kumar S

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/F2KVV4WNnS8>
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/KlJpd_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	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 padagalalu /Virodarthaka padagalalu (Antonyms) Asamanjasa Uchcharane (Inappropriate Pronunciation)

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

Aaharakke sambandisida padagaLu(Names connected with food)

Manavana shareerada bhagagalalu / Angagalalu (Parts of the Human body) Manava Sambhandhada da padhagalalu (Terms Relating to Human Relationship)

Manavana Bhavanegalige sambandisida Padagalalu (Words Relating to Human's feelings and Emotions)

Vaasada staLakke sambhandisidanthaha padhagalalu (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 AaDalita 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' prasarangaa, VTU,2020.

Reference Book:

1. Smt. Kanya Kumari.S – 'Kannada Kali' Kinnari publications' First edition, Bengaluru,2022
2. Lingadevaru Halemane – 'Kannada Kali', Prasaranga 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-1	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Avarage 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

ವಚನಗಳು–ಅಕ್ಕಮಹಾದೇವಿ–ಬಸವಣ್ಣ–ಅಲ್ಲಮಪ್ರಭು

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

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
ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ

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 ಧುರೀಣರು(ವ್ಯಕ್ತಿ ಪರಿಚಯ) ಕಥೆ–ಪ್ರವಾಸ ಕಥನ

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

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, Purvothanasana, Bharadwajasana, Amruthasana, Parivruttha Trikonasana, Parsvakonasana, Ustrasana, Padmasana, Jaaanushirshasana, Navasana, Ardchhakrasana, Ardchakachakrasana, Jataraparivarthanasana, Sethubandasana, Sarvangasana, Mathyasana, Dhanurasana, Shirshasana.

Pranayamas: Anuloma-Viloma, Suryanuloma, Chandranuloma, Brahmari, Suryanbedhana, Chandrabedhana, Sheetal, 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 (COs):

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: CI41	Credits: 2:1:0
Pre – requisites: Calculus and Basic Probability	Contact Hours: 28L+14T
Course Coordinator: Dr. Govindaraju M V and Dr. R Suresh Babu	

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, PowerPoint 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.

Probability Distributions: Random Variables, Binomial distribution, Poisson distribution.

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

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, PowerPoint 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, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105035/>
<https://nptel.ac.in/courses/111/107/111107119/>

Suggested Learning Resources

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 -4th 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. (PO-1, 2 & PSO-2, 3)
2. Fit a least squares curve to the given data and analyze the given random data and its probability distributions. (PO-1, 2 & PSO-2, 3)
3. Find parameters of Continuous Probability distributions and calculate the marginal and conditional distributions of bivariate random variables. (PO-1, 2 & PSO-2, 3)

4. Predict future events using Markov chain and in queuing models. (PO-1, 2 & PSO-2, 3)
5. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1, 2 & PSO-2, 3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3 CO4, CO5

DATA COMMUNICATION AND NETWORKING (INTEGRATED)

Course Code: CI42	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 28L+14P
Course Coordinator: Dr. Thippeswamy M N	

Unit I

Introduction: Overview of the internet- Networks, Network Types, Switching and the Internet, Data Communications. **Networks Model:** Protocol Layering, TCP/IP Protocol suite, The OSI model. **Introduction to Physical Layer:** Data and Signals. **Transmission Media:** Guided Media, Unguided Media: Wireless.
(Text book: Chapter 1.1, 1.2, 1.3, Remaining topics: Ref 1)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106108098>
<https://nptel.ac.in/courses/106105082>
- Impartus Recording: <https://a.impartus.com/ilc/#/course/96149/452>

Unit II

Introduction to Data-Link Layer: Introduction, Link-Layer Addressing. **Data Link Control (DLC):** Data-link layer protocols, HDLC, PPP, framing, flow and error control, error detection and correction. **Media Access Control (MAC):** random access, controlled access and channelization, Wired LANs.
(Chapter 5.1 – 5.5)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106108098>
<https://nptel.ac.in/courses/106105082>
- Impartus Recording: <https://a.impartus.com/ilc/#/course/96149/452>

Unit III

Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPv4 Addresses, Class-full and Classless addressing (CIDR), Forwarding of IP Packets, Internet Protocol (IP), ICMPv4, IPv6 addressing.
(Chapter 4.1, 4.2, 4.5)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106108098>

<https://nptel.ac.in/courses/106105082>

- Impartus Recording: <https://a.impartus.com/ilc/#!/course/96149/452>

Unit IV

Unicast Routing: Introduction: general idea, least-cost routing, Routing algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing, **Unicast Routing Protocols:** Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4), Introduction to Multicast routing (Chapter 4.3, 4.4, 4.5)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106108098>
<https://nptel.ac.in/courses/106105082>
- Impartus Recording: <https://a.impartus.com/ilc/#!/course/96149/452>

Unit V

Transport Layer: Introduction, Transport-Layer Protocols (Stop and wait, Go back N, Selective repeat, Bi-directional), User Datagram Protocol, Transmission Control Protocol. **Application Layer:** Client-Server programming using sockets APIs. (Chapter 3.1-3.4, 2.1, 2.3, 2.5)

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106108098>
- <https://nptel.ac.in/courses/106105082>
- Impartus Recording: <https://a.impartus.com/ilc/#!/course/96149/452>

Suggested Learning Resources

Text Books:

1. Behrouz A. Forouzan, Data Communication and Networking, 5th Edition Tata Mc Graw-Hill

Reference Books:

1. Behrouz A. Forouzan and Firouz Mosharraf: Computer Networks: A top down approach, Special Indian Edition, Tata Mc Graw-Hill.2012.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th edition, Elsevier, 2007.
4. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks Fundamental Concepts and Key Architectures”, 2nd Edition, Mc Graw-Hill Education

Course Outcomes (COs):

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

1. Differentiate between different types of network topologies and data transmission techniques. (PO-1, 2, 3, 4,10, PSO-1,2).
2. Illustrate sliding window and access control protocols of data link layer (PO-1, 2, 3, 4,10, PSO-1,2).
3. Solve problems of IP addressing and routing using various routing protocols and algorithms. (PO-1, 2, 3, 4,10, PSO1,2).
4. Differentiate between connection oriented and connection less services of transport layer (PO-1, 2, 3, 4,10, PSO1,2).
5. Describe the various application layer protocols used by TCP/IP reference mode (PO-1, 2, 3, 4,10, PSO1,2).

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Lab Test	10	CO1, CO2, CO3, CO4, CO5
Lab Record	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Lab Test +Marks scored for Lab Record		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: CI43	Credits: 2:1:0
Pre – requisites: Nil	Contact Hours: 28L+14T
Course Coordinator: Dr. Sini Anna Alex	

Unit I

Asymptotic Bounds and Representation problems of Algorithms: Computational Tractability: Some Initial Attempts at Defining Efficiency, Worst-Case Running Times and Brute-Force Search, Polynomial Time as a Definition of Efficiency, Asymptotic Order of Growth: Properties of Asymptotic Growth Rates, Asymptotic Bounds for Some Common Functions, A Survey of Common Running Times: Linear Time, $O(n \log n)$ Time, $O(n^k)$ Time, Beyond Polynomial Time. Some Representative Problems, A First Problem: Stable Matching.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106131>
<https://nptel.ac.in/courses/106102064>
<https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm>

Unit II

Graphs & Divide and Conquer: Graph Connectivity and Graph Traversal, Breadth-First Search: Exploring a Connected Component, Depth-First Search, Implementing Graph Traversal Using Queues and Stacks: Implementing Breadth-First Search, Implementing Depth-First Search, An Application of Breadth-First Search: The Problem, Designing the Algorithm, Directed Acyclic Graphs and Topological Ordering, The Merge sort Algorithm.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106131>
<https://nptel.ac.in/courses/106102064>
<https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm>

Unit III

Greedy Algorithms: Interval Scheduling: The Greedy Algorithm Stays Ahead: Designing a Greedy Algorithm, Analyzing the Algorithm, Scheduling to Minimize Lateness: An Exchange Argument: The Problem, Designing the Algorithm, Designing and Analyzing the Algorithm, Shortest Paths in a Graph: The Problem,

Designing the Algorithm, Analyzing the Algorithm, The Minimum Spanning Tree Problem: The Problem, Designing Algorithms, Analyzing the Algorithms, Huffman Codes and Data Compression.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106131>
<https://nptel.ac.in/courses/106102064>
<https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm>

Unit IV

Dynamic Programming: Weighted Interval Scheduling: A Recursive Procedure: Designing a Recursive Algorithm, Subset Sums and Knapsacks: Adding a Variable: The Problem, Designing the Algorithm, Shortest Paths in a Graph: The Problem, Designing the Algorithm, The Maximum-Flow Problem.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106106131>
<https://nptel.ac.in/courses/106102064>
<https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm>

Unit V

NP and Computational Intractability: Polynomial-Time Reductions NP-Complete Problems: Circuit Satisfiability: A First NP-Complete Problem, General Strategy for Proving New Problems NPComplete, Sequencing Problems: The Traveling Salesman Problem, The Hamiltonian Cycle Problem.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://www.geeksforgeeks.org/fundamentals-of-algorithms/?ref=shm>

Suggested Learning Resources

Text Books:

1. Algorithm Design, Jon Kleinberg and Eva Tardos, Pearson, 1st Edition 2013.
2. Introduction to the Design & Analysis of Algorithms, Anany Levitin, 3rd Edition, 2012, Pearson education.

Reference Books:

1. Introduction to Algorithms, H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas, 3rd Edition, 2009, MIT press.
2. Fundamentals of Computer Algorithms, Horowitz E., Sartaj Sahni S., Rajasekaran S, 2008, Galgotia Publications.

Course Outcomes (COs):

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

1. Define the basic concepts and analyse worst-case running times of algorithms using asymptotic analysis. (PO-1,2, PSO-1,3)
2. Recognize the design techniques for graph traversal using representative algorithms. (PO-1,2,3, PSO-1,3)
3. Identify how divide and conquer works and analyse complexity of divide and conquer methods by solving recurrence. (PO-1,2,3, PSO-1,3)
4. Illustrate Greedy paradigm and Dynamic programming paradigm using representative algorithms. (PO-1,2,3,4, PSO-2,3)
5. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete. (PO-1,2,3,4, PSO-2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Tutorial Assignment 1	10	CO1, CO2, CO3
Tutorial Assignment 2	10	CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Code: CI44	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. Siddesh G M	

Course Contents

Unit I

Introduction: Why study AI? What is AI? The Turing test. Rationality. Branches of AI. Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Autonomy, Environment and agent design, Structure of Agents, Agent types. **Uninformed Search:** Depth-first, Breadth-first, Uniform-cost, Depth-limited, Iterative deepening. **Informed search:** Best-first, A* search, Heuristics, Hill climbing, Problem of local extrema.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106102220>

Unit II

Game Playing: The minimax algorithm, Resource limitations, Alpha-beta pruning, Constraint satisfaction, Node, arc, path, and k-consistency, Backtracking search, Local search using min-conflicts.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106102220>

Unit III

Agents that reason logically 1: Knowledge -based agents, Logic and representation, Propositional (Boolean) logic. **Agents that reason logically 2:** Inference in propositional logic, Syntax, Semantics, Examples.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106102220>

Unit IV

Advanced problem solving paradigm: Planning: types of planning system, block world problem, logic based planning, Linear planning using a goal stack, Means-ends analysis, Non linear planning strategies, learning plan.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106102220>

Unit V

Knowledge Representation, Expert system Approaches to knowledge representation, knowledge representation using semantic network, Knowledge representation using Frames. Expert system: introduction phases, architecture ES versus Traditional system.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106102220>

Suggested Learning Resources

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014.
2. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, Eleventh Impression 2018.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
4. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
5. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.

Course Outcomes (COs):

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

1. Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search. (PO-1,2,3,4,12, PSO-1,2,3)
2. Develop knowledge base sentences using propositional logic and first order logic. (PO4,5, PSO-1,2,3)
3. Apply the knowledge of Artificial Intelligence to write simple algorithm for agents. (PO-1,4,5,6,7, PSO-1,2,3)
4. Apply the AI knowledge to solve problem on search algorithm. (PO-1,2,3,4,12, PSO-1,2,3)
5. Apply first order logic to solve knowledge engineering process. (PO-4,5,9,10,11,12, PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Case Study	10	CO1, CO2, CO3
Assignment	10	CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

OPERATING SYSTEM

Course Code: CI45	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Akshatha G C	

Unit I

Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations;

Operating system structures: operating system services, user operating system Interface, System calls, Types of system calls, Operating system structure, System boot.

- 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 II

Process Management: Basic concept; Process scheduling; Operations on processes; Inter process Communication.

Threads: Overview; Multithreading models;

Process scheduling: Basic concepts, Scheduling criteria, scheduling algorithms, multiple processor scheduling, Algorithm evaluation.

- 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 III

Process Synchronization: Synchronization, The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

- 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

Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Virtual Memory Management: Background; Demand paging; Copy-on write; Page replacement; Allocation of frames; Thrashing.

- 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

File System: File concept; Access methods; Directory structure; File system mounting; file sharing; protection.

Secondary Storage Structures: Disk scheduling; FCFS Scheduling, SSTF scheduling, SCAN, C-SCAN scheduling, Look Scheduling, CLOOK scheduling.

System Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix.

- 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>

Suggested Learning Resources

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne Operating System Principles, 8th edition Wiley- India,2011

Reference Books:

1. D.M Dhamdhare Operating systems - A concept-based Approach, 2nd Edition, Tata McGraw-Hill, 2002
2. Harvey M Deital Operating systems, 3rd Edition, Addison Wesley, 1990.
3. Operating Systems: Principles and Practice (2nd Edition), by Thomas Anderson and Michael Dahlin.

Course Outcomes (COs):

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

1. Describe the structure of computer system and services provided by Operating system.
2. Apply different scheduling algorithms for Process/Memory/Disk Management
3. Describe Process management and need for controlled access to computing resources by co-operative processes.
4. Apply deadlock detection and prevention algorithms to solve the given problem
5. Illustrate memory management strategies and operating system principles for achieving protection and security.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Case study	10	CO1, CO2, CO3
Assignment	10	CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3 CO4, CO5

EMBEDDED SYSTEMS LABORATORY

Course Code: CIL46	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. Mohana Kumar S	

Course Contents

Introduction to Embedded Systems: What is an Embedded System?, Embedded Systems vs. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded System.

Microcontroller Architecture, Differences between microprocessor and microcontroller, type of microcontrollers, Importance of microcontroller in embedded system, Arduino platforms for programming: Simple programs to blink LEDs.

Introduction to Embedded C Programming, Data types: byte, int, long, float, arrays. Structures: setup (), loop (), functions, {} curly braces, ; semicolon, /*...*/ block comments, // line comments. Variables: variable declaration, variable scope. Arithmetic: compound assignments, comparison operators, and logical operators. Constants: true/false, high/low, input/output. Flow control: if, if else, for, while, do while.

Introduction to Sensors and actuators, Communication – Wireless Communication using Bluetooth, Wi-Fi and RF Modules. Communication Controllers.

RTOS: Real time Operating System, Tasks, Process and Treads, Multiprocessing and Multitasking, Task Scheduling.

***Note: Practical Contents will be based on the theory portions.**

Reference Books:

1. Introduction to Embedded Systems, Shibu K V McGraw Hill Publication.
2. Embedded System Design: Frank Wahid, Tony Givargis A Unified Hardware / Software, Wiley India

Course Outcomes (COs):

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

1. Describe and Analyze the Salient aspects of differentiation between Real time systems and Data Processing system. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)

2. Design embedded systems using Arduino board and Embedded C. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)
3. Conversant with various Sensors, communication protocols used in Embedded applications. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation-Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

ALGORITHMS LABORATORY

Course Code: CIL47	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. Sini Anna Alex	

Course Contents

Sl. No.	List of Programs
1.	Asymptotic bounds and functions
2.	Sorting and searching algorithms with Brute Force technique
3.	Stable matching algorithm
4.	Breadth first search
5.	Depth first search
6.	Merge sort algorithm
7.	Quick sort algorithm
8.	Prim's and Kruskal algorithm
9.	Dijkstra's algorithm
10.	Dynamic Programming approach
11.	Knapsack problem & Subset sum problem
12.	Travelling Salesman Problem

Suggested Learning Resources

Reference Books:

1. Algorithm Design - Jon Kleinberg and Eva Tardos, Tsinghua University Press (2005).
2. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.

Course Outcomes (COs):

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

1. Define the basic concepts and analyze worst-case running times of algorithms using asymptotic analysis. (PO-1,4,10, PSO-1,2)
2. Recognize the design techniques for graph traversal, divide and conquer, greedy and dynamic programming paradigm using representative algorithms. (PO-1,2,3, 5, 7, 9, 10, PSO-1,2,3)
3. Illustrate Branch and bound paradigm through NP complete problems. (PO-1, 3, 4, 10,12, PSO-2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation-Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

WEB TECHNOLOGIES LABORATORY

Course Code: CIL48	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. Thippeswamy M N	

Course Contents

Sl.No	List of programs
1.	Design the following static web pages required for an online book store web site. 1) HOME PAGE: The static home page must contain three frames. 2) LOGIN PAGE 3) CATALOGUE PAGE: The catalogue page should contain the details of all the books available.
2.	a) Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10) b) Develop and demonstrate the usage of inline, internal and external style sheet using CSS.
3.	Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: a) Input: Click on Display Date button using onclick() function Output: Display date in the textbox b) Input: A number n obtained using prompt Output: Factorial of n number using alert c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert.
4.	Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

5.	Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
6.	Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
7.	Implement the following web applications using (a) Servlets (b) JSP A web application that takes a name as input and on submit it shows a hello page where name is taken from the request. It shows the start time at the right top corner of the page and provides a logout button. On clicking this button, it should show a logout page with Thank You message with the duration of usage (hint: Use session to store name and time).
8.	Create modern, scalable and high-speed Web Applications with Node.js a) Installing Packages (npm) b) Working with APIs (Calls)
9.	Write a program to design a simple calculator using (a) JavaScript, Servlet and (b) JSP.
10.	Implement the web applications using React. a. Hooks (use State and use Effect) b. Components (Functional and Class Components) c. Render Props and State Management (Redux) d. Forms
11.	Advanced - a. Blogging Website with backend b. Portfolio Website using React c. Builder Book Open-source web app to write and host documentation or sell books. Built with React, Material-UI, Next, Express, Mongoose, MongoDB d. Counter App A small shopping cart example e. Social Media App
12.	Styling and Styled Component in React JS a. Material UI b. Tailwind CSS

Suggested Learning Resources

Reference Books:

1. Web Application Design and Implementation: Apache 2, PHP5, MySQL, JavaScript, and Linux/UNIX Steven A. Gabarro, December 2006, ©2007, Wiley-IEEE Computer Society Press.
2. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, “ng-book, The Complete Book on Angular 4” September 2016 3. Krasimir Tsonev,
3. “Node.js by Example Paperback”, May 2015.
4. Web link for Angular4.0: <https://angular.io/>
5. Web link for Node.js : <https://nodejs.org/en/>
6. Web link for MongoDB: <https://www.mongodb.com>

Course Outcomes (COs):

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

1. Develop web pages with various media contents using HTML5 (PO-1,2,3,4,5, 9,10,12, PSO-1,3)
2. Create a robust Client-side validation with java script. (PO-1,2,3,4,5,9, 10,12, PSO-1,3)
3. Design dynamic data-driven Web sites using MongoDB and Node.js (PO-1,2, 3,4,5,9, 10,12, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation-Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

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.