



Curriculum Structure & Detailed Syllabus
Master of Computer Applications
(Integrated)
(5-Year Integrated BCA + MCA Program)

Silicon University

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Approval History

ACM#	Date	Resolutions
SU-1	27/04/2024	The proposed curriculum structure of Integrated BCA + MCA (IMCA) was approved in principle by the Academic Council.
SU-2	17/08/2024	The curriculum structure of Integrated BCA + MCA (IMCA) and detailed syllabus of 1st Year was approved by the Academic Council.
SU-3	19/04/2025	The amendments to the curriculum structure of Integrated BCA + MCA (IMCA) and the detailed syllabus up to 2nd Year was approved by the Academic Council.

Program Outcomes

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level.

- PO1. Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
- PO2. Design and develop applications to analyze and solve all computer science related problems.
- PO3. Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
- PO4. Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
- PO5. Integrate and apply efficiently the contemporary IT tools to all computer applications.
- PO6. Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
- PO7. Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
- PO8. Communicate effectively and present technical information in oral and written reports.
- PO9. Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
- PO10. Appreciate the importance of goal setting and to recognize the need for life-long learning.

Program Specific Outcomes (PSOs)

- PSO1. Understand the concepts and applications in various fields of Computer Application like Web designing and development, Mobile application development, and Network & communication technologies.
- PSO2. Apply standard practices and strategies in software development & project development using open-ended programming environments to deliver quality applications for business success.
- PSO3. Employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

Program Educational Objectives (PEOs)

- PEO1. Develop software solutions to problems across a broad range of application domains through analysis and design.
- PEO2. Work professionally and communicate effectively in interdisciplinary environment, either independently or in team, and demonstrate leadership in academia and industry.
- PEO3. Utilize computational techniques and develop software by integrating existing technologies and adapt to new technologies for building rich software applications for benefit of the society.

Course Categories & Definitions

L	Lecture
T	Tutorial
P	Practical / Laboratory / Sessional
WCH	Weekly Contact Hours
UCR	University Core Course
UMC	University Mandatory Course (0-Credit)
PCR	Program Core Course
PEL	Program Elective Course
OEL	Open Elective Course
HNS	Honours (Choice-based) Course
MNR	Minor (Choice-based) Course
OOO	Open Online Course (on NPTEL / Swayam / Other)
INT	Summer Internship
PSI	Practice School / Industry Internship
PRJ	Project Work
SEC	Skill Enhancement Course
VAC	Value Addition Course

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Part I

Curriculum Structure

Curriculum Structure

1st Year Integrated BCA + MCA

Semester I								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
UCR	MG1001	Financial Accounting	3	0	0	3	0	0
UCR	CH1002	Environmental Science & Sustainability	3	0	0	3	0	0
PCR	EC1003	Electronics & Semiconductor Devices	3	0	0	3	0	0
PCR	EC1004	Digital Logic & Computer Design	3	0	0	3	0	0
PCR	CS1005	Computer Programming - I	3	0	0	3	0	0
PRACTICAL								
PCR	EC1005	Digital Logic & Computer Design Lab	0	0	2	0	0	1
PCR	CS1006	Computer Programming - I Lab	0	0	2	0	0	1
PCR	CS1007	Office Productivity Tools Lab	0	0	2	0	0	1
SEC	HS1001	Communicative & Technical English	0	0	4	0	0	2
		SUB-TOTAL	15	0	10	15	0	5
		TOTAL	25			20		

Semester II								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
UCR	MT1003	Linear Algebra & Numerical Methods	3	0	0	3	0	0
UCR	BL1001	Biology for Computer Applications	3	0	0	3	0	0
PCR	EC1006	Microprocessors & Microcontrollers	3	0	0	3	0	0
PCR	CS1008	Computer Programming - II	3	0	0	3	0	0
PCR	CS1009	Web Design with HTML & CSS	3	0	0	3	0	0
PRACTICAL								
PCR	CS1010	Microprocessors & Microcontrollers Lab	0	0	2	0	0	1
PCR	CS1011	Computer Programming - II Lab	0	0	2	0	0	1
PCR	CS1012	Web Design with HTML & CSS Lab	0	0	2	0	0	1
SEC	HS1002	Corporate Communication Skills	0	0	4	0	0	2
		SUB-TOTAL	15	0	10	15	0	5
		TOTAL	25			20		

2nd Year Integrated BCA + MCA

Semester III								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR	MT2005	Discrete Mathematics	3	1	0	3	1	0
UCR	MG2003	Principles of Management	3	0	0	3	0	0
PCR	CS2017	Data Structures Using C	3	1	0	3	1	0
PCR	CS2019	Object Oriented Programming in C++	3	0	0	3	0	0
PCR	CS2021	Interactive Web Development	3	0	0	3	0	0
PRACTICAL								
PCR	CS2018	Data Structures Using C Lab	0	0	4	0	0	2
PCR	CS2020	Object Oriented Programming in C++ Lab	0	0	2	0	0	1
PCR	CS2022	Interactive Web Development Lab	0	0	2	0	0	1
INT	IP2001	Summer Internship - I	0	0	0	0	0	1
		SUB-TOTAL	15	2	8	15	2	5
		TOTAL	25			22		

Semester IV								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR	MT2006	Probability & Statistics	3	1	0	3	1	0
UCR	MG2004	Managerial Economics	3	0	0	3	0	0
PCR	CS2023	Java Programming	3	1	0	3	1	0
PCR	CS2002	Design & Analysis of Algorithms	3	1	0	3	1	0
UMC	HS2001	Constitution of India	2	0	0	0	0	0
PRACTICAL								
PCR	CS2024	Java Programming Lab	0	0	4	0	0	2
PCR	CS2005	Design & Analysis of Algorithms Lab	0	0	2	0	0	1
SEC	HS2002	Soft Skills & Technical Writing	0	0	4	0	0	2
		SUB-TOTAL	14	3	10	12	3	5
		TOTAL	27			20		

3rd Year Integrated BCA + MCA

Semester V								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR		Operating Systems	3	0	0	3	0	0
PCR		Database Management Systems	3	1	0	3	1	0
PCR		Artificial Intelligence	3	0	0	3	0	0
PCR		Software Engineering	3	0	0	3	0	0
UCR		Organizational Behaviour	3	0	0	3	0	0
PRACTICAL								
PCR		Operating Systems Lab	0	0	2	0	0	1
PCR		Database Management Systems Lab	0	0	4	0	0	2
PCR		Programming in Python Lab	0	0	4	0	0	2
INT		Summer Internship - II	0	0	0	0	0	1
		SUB-TOTAL	15	1	10	15	1	6
		TOTAL	26			22		

Semester VI								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR		Operations Research	3	0	0	3	0	0
PCR		Computer Networks	3	0	0	3	0	0
PCR		Computer Organization & Architecture	3	0	0	3	0	0
PEL		Program Elective - I	3	0	0	3	0	0
UMC		Human Values & Professional Ethics	2	0	0	0	0	0
PRACTICAL								
PCR		Computer Networks Lab	0	0	2	0	0	1
PCR		Computer Organization & Architecture Lab	0	0	2	0	0	1
PCR		Mobile Application Development Lab	0	0	4	0	0	2
PRJ		Project - I	0	0	12	0	0	6
		SUB-TOTAL	14	0	20	12	0	10
		TOTAL	34			22		

Note:

If a student opts to exit the Integrated MCA program after successful completion of the 3rd Year, then s/he shall be awarded with only a Bachelor in Computer Applications (BCA) degree as per the provisions of the Academic Regulations.

4th Year Integrated BCA + MCA

Semester VII								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR		Soft Computing	3	0	0	3	0	0
PCR		Internet of Things	3	0	0	3	0	0
PCR		OOAD & Patterns Using UML	3	0	0	3	0	0
PCR		Advanced Java Programming	3	1	0	3	1	0
PEL		Program Elective - II	3	0	0	3	0	0
PRACTICAL								
PCR		Soft Computing Lab	0	0	2	0	0	1
PCR		Internet of Things Lab	0	0	2	0	0	1
PCR		OOAD & Patterns Using UML Lab	0	0	2	0	0	1
PCR		Advanced Java Programming Lab	0	0	4	0	0	2
INT		Summer Internship - III	0	0	0	0	0	1
		SUB-TOTAL	15	1	10	15	1	6
		TOTAL	26			22		

Semester VIII								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
PCR		Cryptography & Internet Security	3	1	0	3	1	0
PCR		Web Application Development	3	1	0	3	1	0
PEL		Program Elective - III	3	0	0	3	0	0
PEL		Program Elective - IV	3	0	0	3	0	0
UCR		Entrepreneurship Development	3	0	0	3	0	0
PRACTICAL								
PCR		Web Application Development Lab	0	0	4	0	0	2
SEC		Emerging Technologies Lab/ Entrepreneurship & Innovation	0	0	4	0	0	2
PCR		Presentation Skills & Technical Seminar	0	0	2	0	0	1
VAC		Yoga / NSS / NCC / PES / CPA *	0	0	2	0	0	0
		SUB-TOTAL	15	2	12	15	2	5
		TOTAL	29			22		

*Value Addition Courses: Yoga - Yoga & Meditation, NSS - National Service Scheme, NCC - National Cadet Corps, PES - Physical Education & Sports, CPA - Creative & Performing Arts. Every student must invest at least 2 hours per week in the chosen course in one semester.

5th Year Integrated BCA + MCA

Semester IX								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
OOO		MOOC - I	0	0	0	3	0	0
PRACTICAL								
PRJ/PSI		Project - II / Industry Internship - I	0	0	24	0	0	12
		SUB-TOTAL	0	0	24	3	0	12
		TOTAL	24			15		

Semester X								
Category	Code	Course Title	WCH L-T-P			Credits L-T-P		
THEORY								
OOO		MOOC - II	0	0	0	3	0	0
PRACTICAL								
PRJ/PSI		Project - III / Industry Internship - II	0	0	24	0	0	12
		SUB-TOTAL	0	0	24	3	0	12
		TOTAL	24			15		

		GRAND TOTAL (10 SEMESTERS)	264			200			
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Note:

1. Courses offered under each elective are given in “List of Electives” on Page 7.
2. MOOC - Massive Open Online Course (on NPTEL / Swayam / Other).
3. Approved list of courses for MOOC (self study) shall be published by the department. Students are advised to complete and pass the same before the end of the final semester.
4. Students opting for Project Work shall undergo the same under the guidance of a faculty member.
5. Students selected for Industry Internship shall be attached to a faculty member as mentor.
6. The Value Addition Course (Yoga / NSS / NCC / PES / CPA) may be assigned in a different semester depending on available capacity.

List of Electives

Code	Elective # and Subjects
	<i>Program Elective - I</i>
	Data Mining & Data Warehousing
	Simulation & Modelling
	Mobile Computing
	<i>Program Elective-II</i>
	Natural Language Processing
	Theory of Computation
	Realtime Systems
	<i>Program Elective-III</i>
	Machine Learning
	Compiler Design
	Cloud Computing
	<i>Program Elective-IV</i>
	Software Testing
	Software Project Management
	E-Commerce & Knowledge Management
	Computer Graphics

Note:

1. The list of electives may be modified as per the recommendation of the Board of Studies.
2. The department shall offer subjects under each program elective depending on available capacity.
3. Unless adequate number of students choose an elective subject offered by the department, the subject shall not be offered and the students shall be assigned with a different elective subject.

Part II

Detailed Syllabus

Category	Code	Financial Accounting	L-T-P	Credits	Marks
UCR	MG1001		3-0-0	3	100

Objectives	To provide basic knowledge of financial accounting and equip the students with the knowledge of accounting process and preparation of final accounts.
Pre-Requisites	Basic knowledge of day to day transactions of any business organization.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Fundamentals of Accounting: Accounting as a business function and language of business, Functions and objectives of Accounting, Users of Accounting information, Limitations of Accounting, Cyclical nature of business and Accounting cycles, Accounting concepts – as applicable to Balance sheet and Income Statements, The rule of debit and credit.	7 Hours
Module-2	Accounting equations, Accounting events and transactions, Classification of transaction and their effect on Accounting Equation, Statement showing the effect of transaction on assets, liabilities and capital, Capital and revenue transactions, Fixed assets and depreciation policy and methods.	8 Hours
Module-3	Recording of transaction: The journal, The ledger postings, Subsidiary Books of Accounts: purchase books, sales books, Cash books.	7 Hours
Module-4	Preparation of Financial Statements of a sole trader: Trial balance, Trading Account, Manufacturing Account, Profit and Loss account, Balance sheet with basic adjustments.	10 Hours
Module-5	Company Accounts: Types of Companies - Private sector, Public sector, Private limited, public limited, Govt. company, holding company and subsidiary company, Capital and types of capital - Authorized Share Capital, Subscribed, issued, paid up share capital, Shares - Equity Shares, Preference shares and types of preference shares, Issue of share capital and treatment of books of Accounts, Journal entries for issue only (forfeiture of shares excluded).	10 Hours
Total		42 Hours

Text Books:

- T1. A. Dash, S. Sahu, and R. K. Bal, *A New Approach to Financial Accounting for Professional Student*, S. Chand Publication, 2010.
 T2. S. P. Jain and K. L. Narang, *Financial Accounting*, Latest Edition, Kalyani Publishers.

Reference Books:

- R1. A. K. Bhattacharya, *Financial Accounting*, Latest Edition, Prentice Hall of India.
 R2. S. N. Maheshwari, Sharad K. Maheshwari, and Suneel K. Maheshwari, *Principles of Financial Accounting*, Vikas Publishing, 2013.

Online Resources:

1. <https://www.mbacrystalball.com/blog/accounting/financial-accounting/>
2. <https://www.myaccountingcourse.com/accounting-basics/financial-accounting>
3. <http://accounting-simplified.com/financial/fixed-assets/capital-and-revenue-expenditure.html>
4. <https://accountlearning.com/understanding-various-types-of-assets-and-liabilities/>
5. <https://syskool.com/a-company-definition-features/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Understand the concepts of accounting and its application in engineering projects.
CO2	Determine the effects of a transaction on assets, liabilities and capital.
CO3	Apply financial record keeping principles in creating accounting software systems.
CO4	Apply the methods of profit & loss computation of an organization in software systems.
CO5	Manage shares and market position of the company by use of computer applications.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO8	Communicate effectively and present technical information in oral and written reports.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1		1					1	1	3			1
CO2	1				1		1			2	1		2
CO3			1	1			1			2			1
CO4	1		1	1			1			2		1	2
CO5			1	1			1						2

Category	Code	Environmental Science & Sustainability	L-T-P	Credits	Marks
UCR	CH1002		3-0-0	3	100

Objectives	The objective of this course is to sensitize the students with essential knowledge of environment & sustainability including pollution, laws, management of solid, hazardous, and e-waste for enhancing long-term sustainability.
Pre-Requisites	Basic knowledge of physics, chemistry and biology is adequate.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with focus on examples and case studies.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Ecology, Ecosystems & Biogeochemical Cycles: Introduction, Ecological perspective, Ecosystems and processes, Trophic pyramids, Biodiversity of species, Water, Oxygen, Nitrogen and Carbon cycle, Environmental gradient and tolerance levels of environmental factors.	9 Hours
Module-2	Water and Waste-Water Treatment: Water quality standards and parameters, Water table, Aquifer, Pre-treatment, Conventional treatment processes of Water, DO, BOD, COD and Microbial Waste-Water treatment.	8 Hours
Module-3	Atmosphere, Soil and Noise: Atmospheric chemistry, Air pollution and associated control equipment, Climate change, Soil chemistry, Noise standards, Noise measurement and noise abatement.	8 Hours
Module-4	Waste Management: Types and management of MSW (Municipal Solid Waste), Hazardous waste and e-waste, Life Cycle Assessment (LCA).	8 Hours
Module-5	Sustainability: Sustainable Development Goals (SDGs), Environmental audit, EIA (Environmental Impact Assessment), EIS (Environmental Impact Statement), Indian environmental laws, UN conferences, Human population and the environment.	9 Hours
Total		42 Hours

Text Books:

- T1. G. M. Masters and W. P. Ela, *An Introduction to Environmental Engineering and Science*, 3rd Ed., PHI Learning, 2015.
- T2. G. Kiely, *Environmental Engineering*, Spl. Indian Edition, McGraw-Hill, 2007.

Reference Books:

- R1. M. L. Davis and S. J. Masten, *Principles of Environmental Engineering and Science*, 2nd Ed., McGraw-Hill, 2017.
- R2. H. D. Kumar and U. N. Dash, *Environmental Studies*, 2nd Ed., IndiaTech Publishers, 2017.

Online Resources:

1. <http://nptel.ac.in/courses/120108002/>: Aquatic Biodiversity and Environmental Pollution.
2. <http://nptel.ac.in/courses/120108004/>: Environment Management.
3. <http://nptel.ac.in/courses/120108005/>: Municipal Solid Waste Management.
4. <https://www.epa.gov/environmental-topics/>: All Current Environmental Issues.

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Describe the concepts of ecology, ecosystems, and biogeochemical cycles in the environment.
CO2	Explain the process of water and wastewater treatment for prevention of water pollution.
CO3	Understand the pollutants in the environment and explore the principles for their eradication.
CO4	Explore waste minimization and management of different types of wastes generated.
CO5	Understand various environmental laws for sustainability and prevention of pollution.

Program Outcomes Relevant to the Course:

PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1			1			1			1	1			1
CO2			1			1			1	1			1
CO3			1			1			1	1			1
CO4			1			1			2	1			1
CO5			1			2			2	1			1

Category	Code	Electronics & Semiconductor Devices	L-T-P	Credits	Marks
PCR	EC1003		3-0-0	3	100

Objectives	The objectives of this course is to introduce the students to the concepts of basic electricity, semiconductors, construction, characteristics of diodes, different types of transistors and Op-Amps in electronic circuits for various applications.
Pre-Requisites	Basic knowledge of physics and mathematics of 12th class level is required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Electric current, Resistance, Ohm's Law, Series & parallel combination of resistances, Kirchoff's current & voltage laws, Thevenin's theorem, Norton's Theorem, Superposition Theorem and Maximum Power Transfer Theorem, Alternating Current (AC) and Direct Current (DC), Instantaneous, Average and RMS values of AC.	8 Hours
Module-2	Classification of solids, Semiconductor, Intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, p-n junction diode, V-I characteristics, Forward and reverse resistances of diode, Rectifiers – half wave and full wave, Zener diode as a voltage regulator.	8 Hours
Module-3	Bipolar Junction Transistors (BJT), Characteristics of Common-base, Common-emitter and Common-collector configurations, Comparison – Transistor as an amplifier (CE), Transistor Biasing – Fixed biased and voltage divider bias method.	8 Hours
Module-4	Field Effect Transistors (FET), Construction, Types of FET – Junction field effect transistor (JFET), Working of JFET, Metal Oxide Semiconductor FET (MOSFET), Construction, Operation and static V-I characteristics of Depletion type and Enhancement type MOSFET.	9 Hours
Module-5	Feedback Amplifier, Positive and Negative feedback amplifiers (Qualitative study only), Applications of Op-Amp – Inverting, Non-inverting, Differential amplifier, Summing amplifier, Integrator and differentiator; Oscillators – Conditions for oscillation, Types of oscillator – RC phase shift, Wien Bridge Oscillator.	9 Hours
Total		42 Hours

Text Books:

- T1. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 11th Ed., Pearson Education, 2013.
- T2. A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 7th Ed., Oxford University Press, 2014.
- T3. B. L. Theraja and A. K. Theraja, *Textbook of Electrical Technology*, Vol-I, 23rd Ed., S. Chand & Co.Ltd., 2002.

Reference Books:

- R1. A. Agarwal and J. Lang, *Foundations of Analog and Digital Electronic Circuits*, 1st Ed., Morgan Kaufmann, 2005.
- R2. V. K. Mehta and R. Mehta, *Principles of Electronics*, 3rd Ed., S. Chand Publishing, 1980.

Online Resources:

1. <https://nptel.ac.in/courses/117/103/117103063/>: by Prof. G. Barua, IIT Guwahati
2. <https://nptel.ac.in/courses/108/101/108101091/>: By Prof. M. B. Patil, IIT Bombay
3. <https://nptel.ac.in/courses/122/106/122106025/>: By Prof. T. S. Natarajan, IIT Madras
4. <https://nptel.ac.in/courses/117/107/117107095/>: Web Content by IIT Roorkee
5. <https://nptel.ac.in/courses/122/104/122104013/>: Web Content by IIT Kanpur

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

CO1	Differentiate between DC and AC sources and analyze various types of electrical networks.
CO2	Design different rectifier circuits using diodes for various applications.
CO3	Apply transistors in different configurations and biasing in various electronic circuits.
CO4	Compare the operation and characteristics of JFET and MOSFET with different biasing.
CO5	Analyze the characteristics of Op-Amp and design circuits using them for various applications.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	2	1	2					1	2	2	2
CO2	2	1	2	2	2					1	2		2
CO3	3		3	2	2					1	2	1	2
CO4	3	2	3	1	1					1	2		2
CO5	2		2	1	2					1	2		1

Category	Code	Digital Logic & Computer Design	L-T-P	Credits	Marks
PCR	EC1004		3-0-0	3	100

Objectives	The objective of this course is to develop an understanding of the concepts and techniques associated with the digital electronics systems and their application in designing modern computer systems.
Pre-Requisites	Basic knowledge of number systems and electronics is required.
Teaching Scheme	Regular class room lectures with use of ICT as and when required; sessions are planned to be interactive with focus on problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Number System and their Conversion, Arithmetic Operation using 1's and 2's compliments, Logic Gates, Universal Logic Gates, Boolean Algebra and De Morgan's Theorem; Realization of Boolean Function using logic gates, Universal Logic Gates, Binary codes, their application and Code Conversion.	8 Hours
Module-2	Boolean Function Simplification, SOP & POS forms, Min term, Max term, Canonical forms, Karnaugh maps up to 4 variables, Combinational Logic Design – Half and Full Adders and Subtractors, Multipliers, Digital Comparators, Multiplexers, De-Multiplexors, Encoder and Decoder.	9 Hours
Module-3	Sequential Logic Design, Flip Flops – 1-bit memory, The clocked S-R, J-K, T and D Flip Flop, Race around Condition, Master-Slave JK Flip Flop, Triggering of Flip Flop, Conversion between the Flip Flop, Ripple, Synchronous and Mod-N Counters.	8 Hours
Module-4	Shift Registers and Counters, Shift Registers SISO, SIPO, PISO, PIPO, Universal Shift Register, Applications of Shift Registers Ring Counter, Twisted Ring Counter (Johnson Counter); Design of Synchronous Counters, Gray Code and Random Sequence Counters using State Diagrams; Finite State Machines (FSMs)– Mealy and Moore models of Finite State Machines.	9 Hours
Module-5	Programmable Logic Devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Semiconductor Memories – Basics of ROM, SRAM and DRAM.	8 Hours
Total		42 Hours

Text Books:

- T1. A. A. Kumar, *Fundamentals of Digital Circuits*, 3rd Ed., PHI Learning, 2014.
- T2. M. M. Mano, *Digital Logic and Computer Design*, 1st Ed., Pearson Education, 2016.

Reference Books:

- R1. D. V. Hall, *Digital Circuits and Systems*, International Student Edition, McGraw-Hill Education, 1989.
- R2. W. H. Gothmann, *Digital Electronics - An Introduction to Theory and Practice*, 2nd Ed., PHI Learning, 1982.
- R3. R. P. Jain, *Modern Digital Electronics*, 4th Ed., McGraw-Hill Education, 2009.

Online Resources:

1. <https://nptel.ac.in/courses/117106086/>: by Prof. S. Srinivasan, IIT Madras
2. <https://nptel.ac.in/courses/117103064/>: Prof. A. Mahanta and Prof. R. P. Palanthinkal, IIT Guwahati
3. <https://nptel.ac.in/courses/117105080/>: by Prof. D. Roychoudhury, IIT Kharagpur
4. <https://swayam.gov.in/course/1392-digital-circuits-and-systems>
5. <http://www.allaboutcircuits.com>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Represent numbers under various number systems and convert one number system to another.
CO2	Simplify any function and implement in the lab using universal logic gates.
CO3	Design various sequential logic circuits and be familiar with counter design.
CO4	Design digital circuits in real time applications including digital watch, digital displays.
CO5	Differentiate between various memory chips and Interface external memory to devices.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	2					1	2	1	2
CO2	2	3	2	2	2					1	3	1	2
CO3	2	3	2		3					1	3	1	1
CO4	2	3	2	1	2					2	2	1	2
CO5	1	2	2	2	2					2	2	1	1

Category	Code	Computer Programming - I	L-T-P	Credits	Marks
PCR	CS1005		3-0-0	3	100

Objectives	The objectives of this course is to introduce the fundamentals of computer programming and provide exposure to problem-solving through computer programs written using the C Programming language.
Pre-Requisites	Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course.
Teaching Scheme	Regular classroom lectures with the use of ICT as and when required; sessions are planned to be interactive with problem-solving and programming activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Computer Fundamentals: Definition, Characteristics, Computer Hardware – Major components, Block diagram, Input-output devices, CPU, Memory, Computer Software – System software, Operating system, Assemblers, Compilers, Interpreters, Linkers, Loaders, Application Software, Evolution of programming languages, Algorithms, Flowchart.	8 Hours
Module-2	Programming in C: Structure of a C program, Character set, Identifier, Keywords, Constants, Variables, Fundamental data types, Operators, Expressions, Statements, Operator precedence and associativity, Type conversion, Input/output statements, Formatted input & output.	9 Hours
Module-3	Decision Making & Branching: Basic concepts, if, if-else, Nested if-else, if-else-if ladder, The switch-case construct, Iterative execution using loops – while, for, do-while, Nested loops, Controlling loop behavior – break, continue, goto, and exit.	9 Hours
Module-4	Arrays (1-D & 2-D): Derived data type, Declaration, initialization, and accessing array elements, Operations on 1-D arrays – Insertion, Deletion, Searching, Sorting, Merging, etc., Operations on 2-D arrays, Multi-dimensional arrays.	8 Hours
Module-5	Functions in C: Monolithic vs Modular programming, Library functions vs User-defined functions, Functions in C – function prototype, function definition, function call, parameter passing, Recursion, Storage classes.	8 Hours
Total		42 Hours

Text Books:

- T1. P. K. Sinha and P. Sinha, *Computer Fundamentals*, 6th Ed., BPB Publications, 2004.
- T2. E. Balagurusamy, *Programming in ANSI C*, 7th Ed., McGraw-Hill Education, 2017.
- T3. Y. Kanetkar, *Let Us C*, 16th Ed., BPB Publications, 2018.

Reference Books:

- R1. R. Thareja, *Programming in C*, 2nd Ed., Oxford University Press, 2006.
- R2. B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd Ed., Pearson Education, 2015.
- R3. H. Schildt, *C: The Complete Reference*, 4th Ed., McGraw-Hill, 2017.

Online Resources:

1. <https://nptel.ac.in/courses/106105171/>: by Prof. A. Basu, IIT Kharagpur
2. <https://nptel.ac.in/courses/106102066/>: by Prof. S. A. Kumar, IIT Delhi
3. <https://nptel.ac.in/courses/106104074/>: by Prof. D. Gupta, IIT Kanpur
4. <https://www.cs.uic.edu/~jbell/CourseNotes/C.Programming/>
5. <http://www.stat.cmu.edu/~hseltman/c/CTips.html>
6. <https://www.learn-c.org/>
7. <https://c-faq.com/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Explain the basics of a computer system and express the logic of a problem using flowcharts.
CO2	Write C programs for simple problems with proper inputs and display formatted output.
CO3	Develop structured C programs with branching and looping using appropriate constructs.
CO4	Solve problems involving 1-D and 2-D arrays and write programs to operate on them.
CO5	Design modular C programs using functions and solve problems using recursive approach.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1		1			2	1	1	2
CO2	3	3	3	2	1		1			1	1	1	2
CO3	3	3	3	2	1		2			2	2	1	2
CO4	3	3	3	2	1		2			2	3	1	2
CO5	3	3	3	2	1		2			2	3	1	2

Category	Code	Digital Logic & Computer Design Lab	L-T-P	Credits	Marks
PCR	EC1005		0-0-2	1	100

Objectives	The objective of the course is to understand the internal structure of logic gates, their implementation using Boolean algebra, design of digital circuits like counters and registers and their application in modern computer systems.
Pre-Requisites	Basic knowledge of digital electronics is required.
Teaching Scheme	Regular laboratory experiments to be conducted under supervision of the faculty with use of ICT as and when required, with the focus on implementation using hardware and software tools.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert, Buffer gates and use of Universal NAND Gate.
2	Gate-level minimization: Two level and multi level implementation of Boolean functions.
3	Combinational Circuits: Design, assemble and test: adders and subtractors (Half and Full).
4	Code Converters, Gray code to Binary and Binary to Gray code.
5	BCD to 7-segment Decoder/Display.
6	Design, implement and test a given design example with: (a) NAND Gates only, (b) NOR Gates only and (c) Using minimum number of Gates.
7	Design with multiplexers and de-multiplexers.
8	Flip-Flop: assemble, test and investigate operation of SR, T, D and J-K Flip-Flops.
9	Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.
10	Counters: Design, assemble and test various ripple and synchronous Counters- decimal counter and Binary Counter with parallel load.
11	Memory Unit: Investigate behavior of RAM and its storage capacity – 16×4 RAM: testing, simulating and memory expansion.
12	Clock-pulse generator: design, implement and test.
13	Parallel adder and accumulator: design, implement and test.
14	Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bit product.

Text Books:

- T1. A. A. Kumar, *Fundamentals of Digital Circuits*, 3rd Ed., PHI Learning, 2014.
 T2. M. M. Mano, *Digital Logic and Computer Design*, 1st Ed., Pearson Education, 2016.

Reference Books:

- R1. D. V. Hall, *Digital Circuits and Systems*, International Student Edition, McGraw-Hill Education, 1989.

- R2. W. H. Gothmann, *Digital Electronics - An Introduction to Theory and Practice*, 2nd Ed., PHI Learning, 1982.
- R3. R. P. Jain, *Modern Digital Electronics*, 4th Ed., McGraw-Hill Education, 2009.

Online Resources:

1. <https://www2.mvcc.edu/users/faculty/jfiore/Resources/DigitalElectronics1LaboratoryManual.pdf>
2. <https://www.elprocus.com/top-digital-electronic-projects-for-electronics-engineering-students/>

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

CO1	Analyze the function of logic gates and implement Boolean functions.
CO2	Explain universal gates and implement Boolean expressions using the same.
CO3	Design and analyze different combinational circuits.
CO4	Design various asynchronous and synchronous circuits.
CO5	Explore the internal circuitry and logic behind any digital computer system.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	3	2					1	2	1	2
CO2	2	3	3	2	1					1	3	1	2
CO3	2	3	2	2	2					1	3	1	2
CO4	2	3	2	1	1					1	2	1	1
CO5	2	2	2	1	2					2	2	1	2

Category	Code	Computer Programming - I Lab	L-T-P	Credits	Marks
PCR	CS1006		0-0-2	1	100

Objectives	The objective of the course is to understand the internal structure of logic gates, their implementation using Boolean algebra, design of digital circuits like counters and registers and their application in modern computer systems.
Pre-Requisites	Basic knowledge of C programming language is required.
Teaching Scheme	Regular laboratory classes are conducted under the supervision of the teacher. The experiments shall comprise of programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Introduction to Linux operating system, Linux commands.
2	Introduction to the vi editor, using vi editor to write programs.
3	Compilation and execution of simple C programs with arithmetic operators.
4	Programs using relational, logical, and conditional operators.
5	Formulate problems on Decision-making statements using if-else and nested if-else.
6	Implement decision-making statements using switch-case constructs.
7	Implement loop-control structures using while, do-while, and for loops.
8	Programs on loop-control structures using nested loops.
9	Programs on control transfer statement using break, continue, goto.
10	Programs on 1-dimensional array operations.
11	Programs on 2-dimensional array operations.
12	Programs on functions using call by value.
13	Programs on functions using recursion.
14	Programs on storage classes and study of their effects.

Text Books:

- T1. E. Balagurusamy, *Programming in ANSI C*, 7th Ed., McGraw-Hill Education, 2017.
- T2. M. Sprankle and J. Hubbard, *Problem Solving and Programming Concepts*, 9th Ed., Pearson Education, 2011.

Reference Books:

- R1. B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd Ed., PHI, 2012.
- R2. H. M. Deitel and P. J. Deitel, *C How to Program*, 3rd Ed., Pearson Education Asia, 2001.
- R3. H. Schildt, *C: The Complete Reference*, 4th Ed., McGraw-Hill Education, 2017.

Online Resources:

1. <https://nptel.ac.in/courses/106105171/>: by Prof. A. Basu, IIT Kharagpur
2. <https://nptel.ac.in/courses/106102066/>: by Prof. S. A. Kumar, IIT Delhi
3. <https://nptel.ac.in/courses/106104074/>: by Prof. D. Gupta, IIT Kanpur
4. <https://www.cs.uic.edu/~jbell/CourseNotes/C.Programming/>
5. <http://www.stat.cmu.edu/~hseltman/c/CTips.html>

6. <https://www.learn-c.org/>

7. <https://c-faq.com/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Write C programs using variables, expressions, and input/output statements.
CO2	Formulate the logic of a problem using relational, logical, and conditional operators.
CO3	Develop structured C programs involving decision-making and different control constructs.
CO4	Develop C programs to solve problems involving a similar set of data items using arrays.
CO5	Construct modular C programs using functions for better maintenance and reusability.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	1	1		1			1	1	1	1
CO2	3	3	3	2	1		1			1	1	1	1
CO3	3	3	3	2	2		2			2	3	1	2
CO4	3	3	3	2	2		2			2	3	1	2
CO5	3	3	3	2	2		2			2	3	1	2

Category	Code	Office Productivity Tools Lab	L-T-P	Credits	Marks
PCR	CS1007		0-0-2	1	100

Objectives	The objective of this laboratory course is to provide practical exposure on common office productivity software for creating documents, spreadsheets, presentations, email, and other modern tools used in daily life of a computer professional.
Pre-Requisites	Basic knowledge of using computers is adequate for this course.
Teaching Scheme	Regular laboratory classes conducted under the supervision of the teacher; the experiments shall comprise of assignments on different office productivity tools.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Working with MS Word documents, basic formatting, fonts, bullets & numbering, page setup & margins, indentation, multiple columns, tables, alignment & spacing.
2	Spelling & grammar checking, working with layout and borders in a Word document.
3	Working with objects, inserting text boxes, pictures, shapes, clip arts, etc.
4	Page breaks & section breaks, headers & footers, different types of views.
5	Working with MS Excel, basics of spreadsheet & workbook, working with multiple sheets, creating, opening, saving, and closing of a workbook.
6	Rows and columns in a sheet, resizing and inserting new rows and columns, inserting different types of data, formatting of data.
7	Cell reference, absolute & relative reference, ranges, entering formula, basic formulae, auto-fill, fill handle, referencing cells in a different file.
8	Sorting and filtering of data in a spreadsheet, conditional formatting.
9	Working with formulae, data analysis and manipulation, working with Pivot Table.
10	Creating charts from data, borders, page layout, and margins, printing of a spreadsheet.
11	Working with MS PowerPoint, Creating slides, basic formatting, layout, and designs.
12	Enhancing slides with clip arts, pictures, and SmartArt, themes and masters.
13	Enhancing slides with animation, transitions, multimedia, delivering a presentation.
14	Creating group e-mail IDs, working with Google Forms and Google Sheets

Text Books:

- T1. S. Jain, *Computer Course: Windows 10 with MS Office 2016*, 1st Ed., BPB Publications, 2018.
 T2. V. P. Singh, *Quintessential Course on MS Office 2016*, 1st Ed., Computech Publications, 2016.

Reference Books:

- R1. R. Arora, *Mastering Advanced Excel*, BPB Publications, 2023.
 R2. M. Nigam, *Data Analysis with Excel*, BPB Publications, 2019.

Online Resources:

- <https://edu.gcfglobal.org/en/word/>
- <https://www.javatpoint.com/ms-word-tutorial>

3. <https://edu.gcfglobal.org/en/excel/>
4. <https://www.javatpoint.com/excel-tutorial>
5. <https://edu.gcfglobal.org/en/powerpoint/>
6. <https://www.javatpoint.com/powerpoint-tutorial>
7. <https://www.analyticsvidhya.com/blog/2021/11/a-comprehensive-guide-on-microsoft-excel-for-data-analysis/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Create well formatted word documents using basic word processing features.
CO2	Create professional grade documents and insert external objects in a document.
CO3	Utilize spreadsheets for various data processing tasks with formulas and functions.
CO4	Design and deliver effective presentations for various requirements.
CO5	Explore and use free productivity apps on cloud like forms, docs, and sheets.

Program Outcomes Relevant to the Course:

PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO8	Communicate effectively and present technical information in oral and written reports.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1			1	1	2			3		2	1		
CO2			2	1	2			3		2	1		
CO3			2	2	2			3		2	1		
CO4			2	1	2			3		2	1		
CO5			2	2	2			3		2	1		

Category	Code	Communicative & Technical English	L-T-P	Credits	Marks
SEC	HS1001		0-0-4	2	100

Objectives	The objective of this laboratory course is to provide practice sessions to enhance the communication ability of the students in the four language skills with special focus on technical communication.
Pre-Requisites	Knowledge of general communication in English is required.
Teaching Scheme	Regular laboratory classes with various tasks designed to facilitate technical communication through pair and/or team activities with regular assessments, presentations, discussions, role-playing, audio-visual supplements, writing activities, business writing practices and vocabulary enhancement.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Introduction to the course and diagnostic test.
2	JAM: content development, structuring and delivery.
3	Group presentation.
4	Effective Verbal Communication exercises: plain English, bias-free language, formal and informal style, usage etc.
5	Activities on non-verbal communication.
6	Sounds of English: Vowels and consonants.
7	Sounds of English: Transcription.
8	Sounds of English: Syllable and stress.
9	Sounds of English: Rhythm.
10	Sounds of English: Intonation I.
11	Sounds of English: Intonation II.
12	Role play on simulated business contexts considering different channels of business communication.
13	Listening comprehension.
14	Practice on elements of business writing.
15	Composing effective paragraphs with unity, coherence, cohesion, progression.
16	Process writing.
17	Writing memos.
18	Emails and email etiquette.
19	Business letter I.
20	Business letter II.
21	Error correction: usage and grammar.
22	Reading Comprehension I: Essay – skimming, scanning, inferential comprehension, critical reading.

Cont'd. . .

Experiment-#	Assignment/Experiment
23	Reading Comprehension II: Short story – Analysing the tone of the author.
24	Reading Comprehension III: News editorial – Differentiating facts from opinion.
25	Reading Comprehension IV: Texts on Science and Technology – Identifying discourse markers.
26	Reading Comprehension V: Texts on Science and Technology – Intensive reading and note-taking.
27	Note-making and summary writing.
28	Verbal Advantage: Vocabulary exercises.

Text Books:

- T1. M. A. Rizvi, *Effective Technical Communication*, 2nd Edition, Tata McGraw Hill, 2017.
 T2. M. Raman and S. Sharma, *Technical Communication: Principles and Practices*, Oxford University Press.
 T3. B. K. Das, K. Samantray, R. Nayak, S. Pani, and S. Mohaty, *An Introduction to Professional English & Soft Skills*, Cambridge Univ. Press, 2009.

Reference Books:

- R1. J. Seeley, *The Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly*, 3rd Ed., Oxford University Press, 2013.
 R2. S. Kumar and P. Lata, *Communication Skills*, Oxford University Press, 2011.
 R3. T. Panigrahi, *Communicative Competence*, 1st Ed., Notion Press, 2024.

Online Resources:

- <https://nptel.ac.in/courses/109/106/109106094/>: by Prof. A. Iqbal, IIT Madras
- <https://nptel.ac.in/courses/109/104/109104031/>: by Dr. T. Ravichandran, IIT Kanpur
- <https://ocw.mit.edu/courses/comparative-media-studies-writing/21w-732-5-introduction-to-technical-communication-explorations-in-scientific-and-technical-writing-fall-2006/download-course-materials/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Communicate with clarity, fluency and impact.
CO2	Develop comprehensive understanding of communication concepts, its importance, types, barriers and principles.
CO3	Communicate effectively in business set-ups.
CO4	Compose coherent, clear and impactful business correspondences.
CO5	Practice sub-skills of reading and become adept readers.

Program Outcomes Relevant to the Course:

PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO8	Communicate effectively and present technical information in oral and written reports.

Cont'd...

PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1				1		1	2	2	3	3	1	1	1
CO2				1		1	1	2	3	3	1	1	1
CO3				1		2	2	3	3	3	1	1	1
CO4				2		2	1	3	1	3	1	1	1
CO5				2		1	1	2	1	3	1	1	1

Category	Code	Linear Algebra & Numerical Methods	L-T-P	Credits	Marks
UCR	MT1003		3-0-0	3	100

Objectives	The objective of this course is to familiarize the students with the Linear Algebra and various computational methods to handle Linear Systems, large-scale Matrices and Interpolations.
Pre-Requisites	Basic concepts of system of Linear Equations and Matrix Algebra, Coordinate Geometry and Elementary Calculus.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with focus on problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Geometry of Linear Equations, Gaussian Elimination, Vector Space & Subspaces, Solving a Linear System, Linear Independence, Basis and Dimension, The Four Fundamental Subspaces, Linear Transformation, Orthogonal Vectors, Projections to a line, Projections and Least Squares, Orthogonal Bases and Gram-Schmidt.	10 Hours
Module-2	Eigen Values and Eigen Vectors, Diagonalization of a Matrix, Complex Matrices, Similarity Transformation, Test for Positive Definiteness, Singular Value Decomposition.	8 Hours
Module-3	Error Analysis, Solution of Non-Linear Equations, Bisection Method, Fixed Point Iteration Method, Secant Method and Newton Method.	8 Hours
Module-4	Interpolation by Polynomials, Lagrange Interpolation, Newton Divided Differences, Newton's forward & backward Interpolation, Cubic Spline Interpolation; Numerical Integration, Trapezoidal and Simpson's Rules, Composite Rules, Error Formulae and Gaussian Quadrature Rules.	8 Hours
Module-5	Linear System of Equations, LU Decomposition, Jacobi and Gauss-Seidel Methods, Eigen Value Problems – Power Method and Inverse Power Method.	8 Hours
Total		42 Hours

Text Books:

- T1. G. Strang, *Linear Algebra and Its Applications*, 4th Ed., Cengage Learning, 2015.
 T2. M. K. Jain, S. R. K. Iyengar, and R. K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 3rd Ed., New Age International Publishers, 2020.

Reference Books:

- R1. E. Kreyszig, *Advanced Engineering Mathematics*, 8th Ed., Wiley India, 2015.

Online Resources:

- <https://nptel.ac.in/courses/111108066/>: by Prof. V. Rao, IISc Bangalore
- <https://nptel.ac.in/courses/117103064/>: by Prof. R. Usha, IIT Madras

P.T.O

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Solve an inconsistent linear system by least square approximation.
CO2	Factorize a matrix using different methods for computational applications.
CO3	Solve a transcendental equation by numerical methods.
CO4	Interpolate a data set using appropriate mathematical technique.
CO5	Apply appropriate numerical methods to solve linear systems and Eigen value problems.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1							2	1	1
CO2	3	3	2	1	1						2	1	1
CO3	3	3	2	2	1						3	1	1
CO4	3	3	2	2	1						3	1	1
CO5	3	3	2	2	1						3	1	1

Category	Code	Biology for Computer Applications	L-T-P	Credits	Marks
UCR	BL1001		3-0-0	3	100

Objectives	The objective of this course is to introduce the basic concepts of modern biology to allow computer professionals analyze problems from both an engineering and biological perspectives, anticipate specific issues in working with living systems, and formulate possible solutions through application of computers.
Pre-Requisites	Basic knowledge of biology, chemistry, and physics is adequate.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with real-world examples and applications.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: Physical and chemical principles involved in maintaining life processes; Cell Structure & Functions (Prokaryotic and Eukaryotic cells), Structure and functions of cellular components, Cell wall, Plasma membrane, Endoplasmic reticulum; Tissue systems – Overview of animal and plant tissue systems, Cell cycle & cell division.	8 Hours
Module-2	Biomolecules: Structure and function of carbohydrates, Lipids, Amino acids, Proteins, and Nucleic acids; Metabolism – Enzymes, Catalysis mechanisms, The spontaneity of biochemical reactions, ATP as an energy currency, Concept of energy charge, Aerobic respiration, Gluconeogenesis.	9 Hours
Module-3	Genetics: Laws of heredity (Mendelian and Non-Mendelian), Mutations – Cause, types, and effects on species, Generic basis of diseases, Origin of Life – Haldane and Oparin's concepts; Evolution – Modern concept of natural selection and speciation, Lamarckism, Darwinism & Neo-Darwinism.	8 Hours
Module-4	Microorganisms & Human Health: Concept of single-celled organisms, Concept of species and strains, Ecological aspects of single-celled organisms, Microbial diseases, Epidemiology, and Public Health; Human immune mechanism, Types of immunity, Antigen & Antibody reactions, Immunological disorders, Auto-immune diseases, Immunological databases and tools.	9 Hours
Module-5	Biotechnology: Basic concepts on Totipotency and Cell manipulation, Recombinant DNA technology and its application in Agriculture, Medicine, and Health; Bioinformatics – Introduction, Software, and Tools of Bioinformatics.	8 Hours
Total		42 Hours

Text Books:

- T1. Wiley Editorial, **Biology for Engineers**, John Wiley & Sons, 2018.
- T2. S. Singh, T. Allen, **Biology for Engineers**, 1st Ed., Vayu Education of India, 2014.
- T3. A. D. Baxevanis and B. F. F. Ouellette, **Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins**, 2nd Ed., Wiley India, 2004.
- T4. U. Satyanarayana, **Biotechnology**, 12th Ed., Books and Allied. 2019.

Reference Books:

- R1. A. T. Johnson, *Biology for Engineers*, 1st Ed., CRC Press, 2010.
 R2. C. D. Tampo and M. A. Lewis, *Diseases of the Human Body*, 6th Ed., F. A. Davis Co., 2016.
 R3. N. A. Campbell, L. A. Urry, M. L. Cain, S. A. Wasserman, P. V. Minorsky, and J. B. Reece, *Biology: A Global Approach*, 10th Ed., Pearson Education, 2014.

Online Resources:

1. <https://nptel.ac.in/courses/121106008>: by Dr. M. Dixit and Prof. G.K. Suraishkumar, IIT Madras
2. <https://www.genome.gov/genetics-glossary/Bioinformatics>

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

CO1	Explain the structure & composition of cells and cellular components.
CO2	Comprehend structure & functions of different types of biomolecules and their interactions.
CO3	Describe basic concepts of genetics and explain hereditary patterns, mutation, and evolution.
CO4	Recognize microbial diseases, defense mechanisms, and immunological databases and tools.
CO5	Explore applications of bioinformatics & biotechnology to solve problems in different domains.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	1		1	1					1		1	1	1
CO2	2		1	1					1		2	1	1
CO3	2		2	2					2	1	2	1	2
CO4	2		2	2					2	1	2	1	3
CO5	3		3	3					2	2	3	2	3

Category	Code	Microprocessors & Microcontrollers	L-T-P	Credits	Marks
PCR	EC1006		3-0-0	3	100

Objectives	The objective of this course is to study different microprocessors and microcontrollers to develop assembly level programs as per user requirements, and interface them with other external devices.
Pre-Requisites	Basic knowledge of digital electronic circuits is required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: 8085 microprocessor & its organization, General architecture, Bus organization, Memory concepts, Pins and Signals, Timing diagram, Instruction Set & programming, Addressing modes, Memory interfacing, Interrupts.	9 Hours
Module-2	Intel 8086 Microprocessor: Bus Interface unit, Execution Unit, Register Organization, Memory Segmentation, Pin architecture, Minimum and Maximum mode, Physical Memory Organization, Memory Interfacing, Interrupts, Addressing Modes, Instructions; Advanced Co-processor Architectures – Intel 80386, Pentium.	9 Hours
Module-3	Interfacing with Peripheral ICs: System level interfacing design with various ICs like 8255 Programmable Peripheral Interface, 8257 DMA Controller, 8259 Programmable Interrupt Controller, 8251 Programmable Communication Interface.	8 Hours
Module-4	Microcontrollers : 8051 systems – Introduction, Architecture, Memory Organization, Special Function Register, Port Operation, Memory Interfacing, I/O Interfacing, Serial Data Transfer Scheme, On board Communication Interfaces – I2C Bus, SPI Bus, USART, External Communication Interfaces- RS232, USB.	8 Hours
Module-5	Microcontroller Programming: 8051 Instruction set, Interrupts, Programming and Applications: Servo motor, Stepper motor control; 8051 Timers and Counters, Serial Communication, I/O Interfacing using 8255, Light Emitting Diodes(LEDs), Push Buttons, Relays and Latch Connections.	8 Hours
Total		42 Hours

Text Books:

- T1. R. S. Gaonkar, *Microprocessor Architecture, Programming and Applications with the 8085*, 6th Ed., Penram International Publishing, 2013.
- T2. A. K. Ray and K. M. Bhurchandani, *Advanced Microprocessors and Peripherals*, 2nd Ed., McGraw Hill Education, 2006.
- T3. M. A. Mazidi, J. G. Mazidi, R. McKinlay, *The 8051 Microcontroller and Embedded Systems: Using Assembly and C*, 2nd Ed., Pearson Education, 2011.

Reference Books:

- R1. K. Kant, *Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096*, 2nd Ed., Prentice Hall India, 2013.
 R2. D. Hall, *Microprocessors and Interfacing*, 3rd Ed., McGraw-Hill Education, 2017.
 R3. K. J. Ayala, *The 8051 Microcontrollers*, 3rd Edition, Cengage Learning, 2004.

Online Resources:

1. <https://nptel.ac.in/courses/108107029/>: by Dr. P. Agarwal, IIT Roorkee
2. <https://nptel.ac.in/courses/106108100/>: by Prof. Krishna Kumar IISc Bangalore
3. <http://www.electrical4u.com/circuit-analysis.htm>
4. <http://www.allaboutcircuits.com>
5. <https://www.electronics-tutorials.ws/>

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

CO1	Describe the architecture & functionality of microprocessors, modes & memory management.
CO2	Explain the architecture, programming & memory interfacing of 8086 Microprocessor, virtual memory and co-processor architecture in different advanced processors.
CO3	Interface external devices like keyboard & display with the processors as per user requirements.
CO4	Describe the functionality of microcontrollers and program them to perform tasks as per needs.
CO5	Explore microprocessor and microcontroller based systems for real world applications.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	1		2						2	2	2
CO2	2	2	2		3						2		2
CO3	3	1	2		3		1			1	2	1	2
CO4	2	2	2		3		1			2	2		2
CO5	2	1	2		3		1			2	3		1

Category	Code	Computer Programming - II	L-T-P	Credits	Marks
PCR	CS1008		3-0-0	3	100

Objectives	The objectives of this course is to study problem-solving using advanced concepts of the C programming language like pointers, structures, and file processing.
Pre-Requisites	Knowledge of basic C programming previously completed and analytical, logical, and problem solving skills is required for this course.
Teaching Scheme	Regular classroom lectures with the use of ICT as and when required; sessions are planned to be interactive with problem-solving and programming activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Arrays and Strings: Review of 1-D and 2-D arrays, Character arrays and strings – Declaration and Initialization, Manipulation, Handling input & output of strings, Operations on strings, Array of strings, Built-in string handling functions in C.	9 Hours
Module-2	User-defined Data Types: Enumeration (enum) and its use, Structures – Declaration and initialization, Creating structure variables, Size of a structure, Slack bytes, Accessing members of a structure, Copying and comparing structure variables, Nested structures, Array of structure, Arrays within structures, Bit-fields in a structure, taking input for bit-fields, Union, Difference between structure and union, typedef.	8 Hours
Module-3	Pointers in C: Concepts of pointer, Declaration and initialization of pointer variable, Accessing variable through a pointer, Pointer arithmetic, Pointer expression, Chain of pointers, Using pointer with arrays and strings, Array of pointers, Pointer to an array, Pointer to structure, Accessing structure members through pointer, Self-referential structures, Idea on linked lists.	8 Hours
Module-4	Pointers & Functions: Parameter passing using call by reference, Passing an array to function, Passing structure to function, Function returning pointer, Pointer to function; Command-line arguments – Passing parameters from the command line, Pre-processor directives, Macros, File inclusion.	8 Hours
Module-5	DMA & File Handling: Dynamic memory allocation using the malloc(), calloc(), and realloc() functions, Need of type-casting, Releasing memory using free() function; File Handling – Concept of files, text vs binary file, File opening and closing, Standard and formatted input/output operation on text files, Random access on files using ftell(), fseek(), and rewind() functions, Binary data reading & writing using fread() and fwrite() functions.	9 Hours
Total		42 Hours

Text Books:

- T1. E. Balagurusamy, *Programming in ANSI C*, 7th Ed., McGraw-Hill Education, 2017.
- T2. Y. Kanetker, *Let Us C*, 16th Ed., BPB Publications, 2018.

P.T.O

Reference Books:

- R1. R. Thareja, *Programming in C*, 2nd Ed., Oxford University Press, 2006.
- R2. B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd Ed., Pearson Education, 2015.
- R3. H. Schildt, *C: The Complete Reference*, 4th Ed., McGraw-Hill, 2017.
- R4. B. Gottfried, *Schaum's Outline of Programming with C*, 3rd Ed., McGraw-Hill, 2017.

Online Resources:

1. <https://nptel.ac.in/courses/106105171/>: by Prof. A. Basu, IIT Kharagpur
2. <https://nptel.ac.in/courses/106102066/>: by Prof. S. A. Kumar, IIT Delhi
3. <https://nptel.ac.in/courses/106104074/>: by Prof. D. Gupta, IIT Kanpur
4. <https://www.cs.uic.edu/~jbell/CourseNotes/C.Programming/>
5. <http://www.stat.cmu.edu/~hseltman/c/CTips.html>
6. <https://www.learn-c.org/>
7. <https://c-faq.com/>

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

CO1	Perform various operations on character arrays and strings in C programs.
CO2	Create user-defined data types to handle heterogeneous data items.
CO3	Write efficient C programs using the concepts of pointers in multiple ways.
CO4	Develop programs using command-line arguments, pre-processor directives, and macros.
CO5	Apply run-time memory management and develop C programs to create and manipulate files.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	2	2		2			2	3	3	2
CO2	3	3	3	2	2		2			2	3	3	2
CO3	3	3	3	2	2		2			2	3	3	2
CO4	3	3	3	2	2		2			2	2	2	1
CO5	3	3	3	2	2		2			2	3	3	2

Category	Code	Web Design with HTML & CSS	L-T-P	Credits	Marks
PCR	CS1009		3-0-0	3	100

Objectives	The objectives of this course is to learn designing and creating static web pages using HTML, styling them using CSS, and creating responsive layouts to make attractive websites that are accessible from various devices.
Pre-Requisites	Basic computer skills and idea of internet and websites is adequate for this course.
Teaching Scheme	Regular classroom lectures with the use of ICT as and when required; sessions are planned to be interactive with focus on designing and programming activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: History of Internet, TCP/IP, IP Address - IPv4 & IPv6, DNS, Structure of URL, World Wide Web, Web page, Website, Web server, Web browser, MIME types, Web hosting, Client-server Model, The HTTP Request-Response Model, Request & response headers, Response codes, Structure of a website, Planning & designing a website, Static vs. dynamic websites.	7 Hours
Module-2	HTML: Structure of a web page, HTML tags, attributes, and elements, Basic HTML tags, Text formatting, HTML entities, Fonts & colors, Lists & nested lists, Hyperlinks, Bookmarks, Tables, merging of cells, nested tables, Images & image maps, Forms & form elements, Boolean attributes.	10 Hours
Module-3	Audio & Video: Embedding audio and video content, attributes, and MIME types, Embedding external content using iframe, Embedding multimedia content (YouTube videos, Google Maps, etc.); The div & span tags, Semantic tags - header, footer, section, article, aside, nav; Metadata & SEO: The meta tag, Character set, Keywords, Description, Author, Viewport.	8 Hours
Module-4	CSS: Overview of CSS, Inline, internal, and external CSS, Syntax of CSS rules, Selectors, Order and specificity, Style properties, Fonts, Colors, Alignment, CSS Box Model - margin, border, padding, and content, Positioning elements - static, relative, absolute, and fixed, Styling tables and forms, Background colors and images, Adding shadow and gradients, CSS tips & tricks.	9 Hours
Module-5	Responsive Layout: Flex containers and flex items, Responsive layouts with Flexbox, Grid layout - container, rows, columns and items, Transitions & animations - Introduction, Transitioning properties, Creating keyframe animations, Adding animation delays & timing functions, Responsive web design - viewport and breakpoints, Syntax & usage of media queries, Creating responsive layouts for different screen sizes, Introduction to CSS frameworks.	8 Hours
Total		42 Hours

Text Books:

- T1. T. A. Powell, *HTML & CSS: The Complete Reference*, 5th Ed., McGraw-Hill Education, 2017.
- T2. J. Duckett, *HTML & CSS: Design and Build Webs*, 1st Ed., Wiley India, 2011.

Reference Books:

- R1. B. Frain, T. Firdaus, and B. LaGrone, *HTML5 and CSS3: Building Responsive Websites*, 1st Ed., Packt Publishing, 2016.
- R2. P. Kumar, *Web Design With HTML & CSS : HTML & CSS Complete Beginner's Guide*, 1st Ed., Notion Press, 2021.

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105084/>: by Prof. I. Sengupta, IIT Kharagpur
2. <https://www.w3schools.com/html/>
3. <https://www.w3schools.com/css/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Explain the basics and working of Internet and the World Wide Web.
CO2	Develop structured web pages using HTML, display data and collect user data through forms.
CO3	Create multimedia enriched web pages, understand semantic elements and use of metadata.
CO4	Design visually appealing websites using the power of CSS and test for browser compatibility.
CO5	Develop responsive websites accessible from various devices and explore advanced frameworks.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	1	3	1				2	1		
CO2	2	3	3	1	3	1				3	2	1	
CO3	2	3	3	1	3	1				3	3	2	1
CO4	2	3	3	1	3	1				3	3	2	2
CO5	2	3	3	1	3	1				3	3	3	3

Category	Code	Microprocessors & Microcontrollers Lab	L-T-P	Credits	Marks
PCR	CS1010		0-0-2	1	100

Objectives	The objective of the course is to provide hands-on practice on programming of microprocessors and microcontrollers and their interfacing with external devices.
Pre-Requisites	Basic analytical skills including basic knowledge of digital electronics is required.
Teaching Scheme	Regular laboratory experiments to be conducted under the supervision of the teacher; the experiments shall consist of programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Program for arithmetic operations using 8085.
2	Program for finding the largest and smallest from a set of numbers using 8085.
3	Program for arranging numbers in ascending and descending order using 8085.
4	Programs for 16 bit arithmetic operations using 8086.
5	Programs for Sorting and Searching (using 8086).
6	Programs for String manipulation operations (using 8086).
7	Interfacing ADC and DAC.
8	Parallel Communication between two MP Kits using Mode-1 and Mode-2 of 8255.
9	Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
10	Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
11	Interfacing and Programming of Stepper Motor and DC Motor Speed control.
12	Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
13	Communication between 8051 Microcontroller kit and PC.
14	A design problem using 8051 (such as multi-parameter data acquisition system, voltmeter, power meter, frequency counter, traffic simulation, digital clock etc.)

Text Books:

- T1. R. S. Gaonkar, *Microprocessor Architecture, Programming and Applications with the 8085*, 6th Ed., Penram International Publishing, 2013.
- T2. A. K. Ray and K. M. Bhurchandani, *Advanced Microprocessors and Peripherals*, 2nd Ed., McGraw Hill Education, 2006.
- T3. M. A. Mazidi, J. G. Mazidi, R. McKinlay, *The 8051 Microcontroller and Embedded Systems: Using Assembly and C*, 2nd Ed., Pearson Education, 2011.

Reference Books:

- R1. K. Kant, *Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096*, 2nd Ed., Prentice Hall India, 2013.
- R2. D. Hall, *Microprocessors and Interfacing*, 3rd Ed., McGraw-Hill Education, 2017.
- R3. K. J. Ayala, *The 8051 Microcontrollers*, 3rd Edition, Cengage Learning, 2004.

Online Resources:

1. <https://nptel.ac.in/courses/108105102/7>
2. <https://nptel.ac.in/courses/108107029/>
3. <https://nptel.ac.in/courses/108105102/38>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Describe the assembly language programming & instruction sets of 8086 microprocessor.
CO2	Write assembly language programs using various arithmetic, logical, and string operations.
CO3	Develop assembly level programs for finding largest/smallest numbers, existence of data, etc.
CO4	Explore assembly level programming of 8051 microcontroller & its applications in real world.
CO5	Interface microprocessors and microcontrollers with external peripheral devices.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3		2						2	3	2
CO2	2	2	2		3						2		2
CO3	2	2	3		3					3	3	2	2
CO4	2	2	1		3					2	2		2
CO5	2	2	3		3						3		2

Category	Code	Computer Programming - II Lab	L-T-P	Credits	Marks
PCR	CS1011		0-0-2	1	100

Objectives	The objectives of this course is to provide hands-on practice on programming and problem-solving using advanced features of the C programming language like pointers, structures, command-line arguments, and file processing.
Pre-Requisites	Knowledge of basic C programming and topics taught in the class is required.
Teaching Scheme	Regular laboratory classes are conducted under the supervision of the teacher. The experiments shall comprise of programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Programs on input/output of strings and simple operations on strings.
2	Programs on strings using built-in string handling functions.
3	Programs on creating and using simple and nested structures.
4	Programs on bit-fields, array of structures, union, and enum.
5	Programs on use of pointers with variables of different data-types.
6	Programs on array operations using pointers.
7	Programs on string manipulation using pointers.
8	Programs on pointers to structures.
9	Programs on functions using call by reference.
10	Programs on passing arrays (1D and 2D) and structures to functions.
11	Programs on designing user-defined functions for string manipulation.
12	Programs on command-line arguments, pre-processor directives, and macros.
13	Programs on various operations on text files.
14	Programs on various operations on binary files.

Text Books:

- T1. E. Balagurusamy, *Programming in ANSI C*, 7th Ed., McGraw-Hill Education, 2017.
- T2. M. Sprankle and J. Hubbard, *Problem Solving and Programming Concepts*, 9th Ed., Pearson Education, 2011.

Reference Books:

- R1. B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd Ed., PHI, 2012.
- R2. H. M. Deitel and P. J. Deitel, *C How to Program*, 3rd Ed., Pearson Education Asia, 2001.
- R3. H. Schildt, *C: The Complete Reference*, 4th Ed., McGraw-Hill Education, 2017.

Online Resources:

1. <https://nptel.ac.in/courses/106105171/>: by Prof. A. Basu, IIT Kharagpur
2. <https://nptel.ac.in/courses/106102066/>: by Prof. S. A. Kumar, IIT Delhi
3. <https://nptel.ac.in/courses/106104074/>: by Prof. D. Gupta, IIT Kanpur
4. <https://www.cs.uic.edu/~jbell/CourseNotes/C.Programming/>
5. <http://www.stat.cmu.edu/~hseltman/c/CTips.html>

6. <https://www.learn-c.org/>

7. <https://c-faq.com/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Develop C programs for manipulation of character arrays and strings.
CO2	Manipulate heterogeneous data items using structure, bit-fields, and union.
CO3	Develop efficient C programs using pointers and call by reference.
CO4	Construct C programs using command line arguments, pre-processor directives, and macros.
CO5	Manage memory at run-time as required and manipulate data stored in text or binary files.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	2	2		2			2	3	3	2
CO2	3	3	3	2	2		2			2	3	3	2
CO3	3	3	3	2	2		2			2	3	3	2
CO4	3	3	3	2	2		2			2	3	2	1
CO5	3	3	3	2	2		2			2	3	3	2

Category	Code	Web Design with HTML & CSS Lab	L-T-P	Credits	Marks
PCR	CS1012		0-0-2	1	100

Objectives	The objective of this laboratory course is to provide hands-on exercises on designing attractive and multimedia enriched semantic web pages using HTML and CSS including creating user-friendly responsive layouts.
Pre-Requisites	Familiarity with internet browsing and basic skills on text editors is required.
Teaching Scheme	Regular laboratory classes are conducted under the supervision of the teacher. The experiments shall comprise of coding assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Find out IP Address, DNS query, Capture HTTP Request & Response.
2	Create a basic HTML web page with headings, paragraphs, and images.
3	Navigation using hyperlinks and bookmarks.
4	Create different types of lists and nested lists.
5	Design forms with different input types and form elements.
6	Utilize semantic HTML elements and meta data.
7	Create an image gallery application with iframe.
8	Embed audio, video, and other external resources on a web page.
9	Style text content using basic CSS properties for font, color, and alignment.
10	Use of CSS selectors to target specific elements on a web page.
11	Apply CSS box model properties to create spacing and borders around elements.
12	Styling tables and form elements using CSS.
13	Create multi-column layout using CSS flexbox & grid and organize content in cells.
14	Apply CSS transitions to animate changes in element properties.

Text Books:

- T1. T. A. Powell, *HTML & CSS: The Complete Reference*, 5th Ed., McGraw-Hill Education, 2017.
T2. J. Duckett, *HTML & CSS: Design and Build Webs*, 1st Ed., Wiley India, 2011.

Reference Books:

- R1. B. Frain, T. Firdaus, and B. LaGrone, *HTML5 and CSS3: Building Responsive Websites*, 1st Ed., Packt Publishing, 2016.
R2. P. Kumar, *Web Design With HTML & CSS : HTML & CSS Complete Beginner's Guide*, 1st Ed., Notion Press, 2021.

Online Resources:

- <https://nptel.ac.in/courses/106/105/106105084/>: by Prof. I. Sengupta, IIT Kharagpur
- <https://www.w3schools.com/html/>
- <https://www.w3schools.com/css/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Develop structured & semantically meaningful web pages using HTML.
CO2	Display data on the website in an organized manner and design forms to collect user data.
CO3	Create multimedia enriched web pages, understand semantic elements and use of metadata.
CO4	Design visually appealing websites using the power of CSS and test for browser compatibility.
CO5	Develop a responsive website from a given design using appropriate tools and frameworks.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	3	1	3	1				2	1		
CO2	2	3	3	1	3	1				3	2	1	
CO3	2	3	3	1	3	1				3	3	2	1
CO4	2	3	3	1	3	1				3	3	2	2
CO5	2	3	3	1	3	1				3	3	3	3

Category	Code	Corporate Communication Skills	L-T-P	Credits	Marks
SEC	HS1002		0-0-4	2	100

Objectives	The objective of this laboratory course is to give students adequate practice in a simulated professional environment with focus on communication skills with professionalism in a typical corporate set up.
Pre-Requisites	Knowledge of communicative and technical English is required.
Teaching Scheme	Regular laboratory classes with various tasks designed to facilitate communication and soft skills through pair and/or team activities with regular assessments, presentations, discussions, role-playing, audio-visual supplements, writing activities, business writing practices and vocabulary enhancement.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Aspects of Inter-cultural communication and cultural conditioning.
2	Barriers to cross-cultural communication.
3	Personality test and personality development.
4	Team work and its stages.
5	Team work and leadership: Simulation.
6	Negotiation skills: Role-play.
7	Persuasive presentation I.
8	Persuasive presentation II.
9	Writing a blog.
10	Vlog making and presentation I.
11	Vlog making and presentation II.
12	Emotional Intelligence: its importance in the workplace.
13	Time management.
14	Social media etiquette.
15	Business etiquette.
16	Assertiveness at work: Role-play.
17	Power point presentation I.
18	Power point presentation II.
19	Power point presentation III.
20	Power point presentation IV.
21	Mind mapping.
22	Creative and critical thinking for problem solving.
23	Six thinking hats: Problem solving and decision making in meetings.
24	Verbal Ability I: synonyms and antonyms.

Cont'd...

Experiment-#	Assignment/Experiment
25	Verbal Ability II: One word substitution.
26	Verbal Ability III: Error correction.
27	Verbal Ability IV: Odd one out.
28	Verbal Ability V: Analogy.

Text Books:

- T1. S. B. Bachu, *Corporate Communication Skills for Professionals*, 1st Ed., White Falcon Publishing, 2021.
- T2. M. A. Rizvi, *Effective Technical Communication*, 2nd Ed., Tata McGraw-Hill, 2017.
- T3. M. Raman and S. Sharma, *Technical Communication: Principles and Practice*, 3rd Ed., Oxford University Press, 2015.

Reference Books:

- R1. P. A. Argenti and J. Forman, *The Power of Corporate Communication: Crafting the Voice and Image of Your Business*, 1st Ed., Tata McGraw-Hill, 2003.
- R2. J. Seely, *The Oxford Guide to Writing and Speaking*, 3rd Ed., Oxford University Press, 2013.
- R3. B. K. Mitra, *Effective Technical Communication - A Guide for Scientists and Engineers*, 1st Ed., Oxford University Press, 2006.

Online Resources:

- <https://archive.nptel.ac.in/courses/109/105/109105144/>: by Prof. S. Singh, IIT Kharagpur
- <https://archive.nptel.ac.in/courses/109/106/109106129/>: by Dr. Ay. I. Viswamohan, IIT Madras
- <https://archive.nptel.ac.in/courses/109/104/109104030/>: by Dr. T. Ravichandran, IIT Kanpur
- <https://www.ef.com/wwen/english-resources/>
- https://owl.purdue.edu/owl/purdue_owl.html
- <https://www.usingenglish.com/>
- <http://www.english-test.net>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Understand aspects of communication at the workplace and check the barriers.
CO2	Hone persuasive communication skills.
CO3	Enhance interpersonal communication at the corporate workplace.
CO4	Make impactful group/solo presentations and communicate with clarity.
CO5	Enhance verbal ability for better communication.

Program Outcomes Relevant to the Course:

PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO8	Communicate effectively and present technical information in oral and written reports.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1				2		2	3	3	2	3	1	1	1
CO2				2		2	3	3	3	3	1	1	1
CO3				2		3	3	3	3	3	1	1	1
CO4				2		3	3	3	3	3	1	1	1
CO5				2		2	3	3	2	3	1	1	1

Category	Code	Discrete Mathematics	L-T-P	Credits	Marks
PCR	MT2005		3-1-0	4	100

Objectives	The objective of this course is to obtain mathematical maturity on logical & abstract processes, discrete structures including graphs which are essential for students in various computer applications.
Pre-Requisites	Knowledge of Sets, basics of number systems, and matrix algebra is required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with focus on problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Proof Strategies.	12 Hours
Module-2	Mathematical induction, basics of counting, Pigeonhole principle, Generalized permutation and combinations; Recurrence Relations, solving linear Recurrence Relations, Generating functions, Inclusion and Exclusion with applications.	11 Hours
Module-3	Relations and their properties, N-ary Relations & their applications, representing relations, Closure of relations, Equivalence relations, partial ordering and Lattice.	11 Hours
Module-4	Introduction to Graphs, Graph terminology, Representation of graphs & graph isomorphism, Connectivity, Euler & Hamilton paths, Planar graph & Graph colouring; Trees, Spanning trees.	12 Hours
Module-5	Semigroup, Monoid, Groups, Subgroups, Cosets and Lagrange's theorem, Codes and group codes, Rings, Integral Domains & Fields.	10 Hours
Total		56 Hours

Text Books:

- T1. K. H. Rosen, *Discrete Mathematics and Its Applications*, 6th Ed., Tata McGraw-Hill, 2008.
T2. C. L. Liu, *Elements of Discrete Mathematics*, 2nd Ed., Tata McGraw-Hill, 2008.

Reference Books:

- R1. J. P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, 1st Ed., McGraw-Hill Education, 2017.
R2. J. R. Mott, A. Kandel, and T. P. Baker, *Discrete Mathematics for Computer Scientists and Mathematicians*, 2nd Ed., Pearson Education, 2015.

Online Resources:

- <https://nptel.ac.in/courses/106104573>: by Prof. N. Saxena, IIT Kanpur
- <https://nptel.ac.in/courses/106106183>: by Dr. A. Shukla and Prof. S. Iyengar, IIT Ropar
- <https://nptel.ac.in/courses/106108227>: by Prof. A. Choudhury, IIIT Bangalore
- <https://nptel.ac.in/courses/106103205>: by Prof. B. George and Prof. S. Gopalan, IIT Guwahati

P.T.O

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Apply logic for logical inferences in real life problems.
CO2	Apply principle of inclusion & exclusion, generating functions and recurrence relations to solve counting problems.
CO3	Understand and apply the concepts of relation and lattice.
CO4	Apply graph theory to real-life problems of computer science & engineering.
CO5	Differentiate the discrete algebraic structures and apply them to study group codes.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				1		2	1	1
CO2	3	3	3	2	2						2	1	1
CO3	3	2	2	1	1						2	1	1
CO4	3	3	3	2	3				1	1	2	1	1
CO5	3	2	2	1	1						2	1	1

Category	Code	Principles of Management	L-T-P	Credits	Marks
UCR	MG2003		3-0-0	3	100

Objectives	The objective of this course is to understand and apply fundamental concepts of management to effectively manage an organization for maximizing efficiency, achieving organizational goals, and ensuring the overall success of the business.
Pre-Requisites	Basic knowledge of operation of any business organization is adequate.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with examples and case studies.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction to Management, Meaning, Nature & Significance, Combination of Art & Science, Management as a Profession, Management vs Administration, Levels of Management, Elements of managerial processes, Styles & Roles of Managers in Organizations, Contributions of Taylor and Fayol, Human Relations & Behavioural Schools, Hawthorne Studies.	9 Hours
Module-2	Planning - Nature, Process of Planning, Planning and Environmental Uncertainties, Types of Planning, Advantages and Limitations of Planning, Decision Making, Stages in Decision Making.	8 Hours
Module-3	Nature & Significance of Organization, Authority & Responsibility Relationships, Span of Control, Process of Delegations, Barriers to Delegation, Centralization & Decentralization, Concept of Line & Staff, Overcoming Line-Staff conflict, Committees, Coordination, Organization Structures, Types, Advantages & Disadvantages.	8 Hours
Module-4	Staffing, Motivation & Leadership, Scope of Staffing Functions, Theories of Motivation, Positive and Negative Motivation, Group Motivation, Theory X, Theory Y, Theory Z, Maslow's need hierarchy, Leadership Definition, Meaning, Factors, Theories, Principles and Leadership Styles.	9 Hours
Module-5	Communications of Control, Process of Communication, Verbal & Non-Verbal, Barriers to communication, Types, Process, Tools of control, Characteristics of Effective Control System, Human Reaction to control system, Social Responsibility – Meaning, Definition, Features, Scope, Social Responsibility of a Manager, Interested Group – Shareholders, Workers, Customers, Creditors, Suppliers, Government, Society, Indian Business and Social Responsibility.	8 Hours
Total		42 Hours

Text Books:

- T1. P. F. Ducker, *The Practice of Management*, Harvard Business Press, 2010.
- T2. P. F. Ducker, *Management: Tasks, Responsibilities and Practices*, Harper Collins, 2009.
- T3. S. P. Robbins and M. A. Coulter, *Management*, 15th Global Ed., Pearson, 2020.

Reference Books:

- R1. P. Durai, *Principles Of Management: Text and Cases*, 2nd Ed., Pearson, 2019.
- R2. P. Kapoor, *Principles of Management*, 1st Ed., Khanna Publishing House, 2019.

- R3. K. Navarathinam, *Principles of Management*, 1st Ed., Shanlax Publications, 2015.
 R4. L. M. Prasad, *Principles and Practices of Management*, 1st Ed., S. Chand & Sons, 2020.

Online Resources:

1. <https://nptel.ac.in/courses/110107150>: by Prof. U. Lenka, IIT Roorkee
2. <https://nptel.ac.in/courses/110105146>: by Prof. Srinivasan and Mukhopadhyay, IIT Kharagpur
3. https://baou.edu.in/assets/pdf/PGDBA_101_slm.pdf

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Describe the importance of principles of management.
CO2	Associate the importance of planning and decision making in an organization.
CO3	Interpret the knowledge of organization and its types.
CO4	Acquire concepts in motivation, leadership and responsibilities as a manager.
CO5	Summarize effective control in the management and practice management functions.

Program Outcomes Relevant to the Course:

PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO8	Communicate effectively and present technical information in oral and written reports.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1			1			1	1	1	1	1			
CO2			1		1	1	2	2	2	1	1		
CO3			1	1		2	2	2	2	1		1	
CO4			1	1	1	3	3	3	3	2		1	1
CO5			1	1		3	3	3	3	2		2	2

Category	Code	Data Structures Using C	L-T-P	Credits	Marks
PCR	CS2017		3-1-0	4	100

Objectives	The objective of this course is to understand the abstract data types, solve problems using appropriate data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees and graphs.
Pre-Requisites	Knowledge of programming in C, specifically on structures, pointers, functions, recursion etc., are required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with programming and problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction, classification of data structures, algorithms, time and space analysis of algorithms, asymptotic notation, abstract data types, Arrays - introduction, basic operations on array (traverse, insert, delete, search), row and column major representation, sparse matrix representation of sparse matrix using triplet form, operations on sparse matrix (addition, transpose).	10 Hours
Module-2	ADT Stack - stack model, representation of stack using array, basic operations with analysis, applications- recursion, and conversion of infix to postfix expression, evaluation of postfix expression; ADT Queue - queue model, representation using array, basic operations with analysis, circular queue, introduction to priority queue and double ended queue.	12 Hours
Module-3	Linked list - introduction, types of linked list (single, double, circular), representation in memory, operations on linked list (traverse, search, insert, delete, sort, merge) in each type with analysis. Representation of polynomial and its operations (addition, multiplication), implementation of stack and queue using linked list.	12 Hours
Module-4	Tree - terminology, representation, binary tree - tree traversal algorithms with and without recursion; Binary search tree, Operations on Binary Search Tree with analysis, threaded binary tree, general tree, Height balanced tree (AVL tree), m-way search trees, B-trees; Graph - terminology, representation (adjacency matrix, incidence matrix, path matrix, linked representation), graph traversal (BFS, DFS), Dijkstra's single source shortest path algorithm, Warshall's all pair shortest path algorithm, topological sort.	12 Hours
Module-5	Sorting algorithms - bubble sort, selection sort, insertion sort, quick sort, merge sort, radix sort, heap sort; Hashing - hash functions and hashing techniques, collision resolution - linear & quadratic probing, chaining.	10 Hours
Total		56 Hours

Text Books:

- T1. M. Weiss, *Data Structures and Algorithm Analysis in C*, 2nd Ed., Pearson Education, 2002.
- T2. E. Horowitz, S. Sahni, and S. Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Ed., Universities Press, 2008.

Reference Books:

- R1. A. Tenenbaum, Y. Langsam, and M. J. Augenstein, *Data Structures Using C*, 3rd Ed., Pearson Education 2007.
- R2. J. P. Tremblay and P. G. Sorenson, *An Introduction to Data Structures with Applications*, 2nd Ed., Tata McGraw-Hill, 2017.
- R3. S. Lipchitz, *Data Structures*, 1st Revised Ed., McGraw-Hill Education, 2014.

Online Resources:

1. <https://nptel.ac.in/courses/106106127>: By Prof. H. A. Murthy, et al., IIT Madras
2. <https://nptel.ac.in/courses/106102064>: By Prof. N. Garg, IIT Delhi
3. <https://nptel.ac.in/courses/106106130>: By Dr. N. S. Narayanaswamy, IIT Madras
4. <https://nptel.ac.in/courses/106106133>: By Prof. H. A. Murthy, et al., IIT Madras

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Compare different programming methodologies and define asymptotic notations to analyze performance of algorithms and get acquainted with array and sparse matrix.
CO2	Apply the basic operations of stacks and queues to solve real world problems.
CO3	Use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.
CO4	Represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.
CO5	Apply the knowledge of different searching , sorting techniques and various hashing techniques.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3		1	2	1				2	1	1	2
CO2	3	3		1	3	2				1	1	1	2
CO3	3	3		1	3	2				2	2	1	2
CO4	3	3		1	3	2				2	3	1	2
CO5	3	3		1	3	2				2	3	1	2

Category	Code	Object Oriented Programming in C++	L-T-P	Credits	Marks
PCR	CS2019		3-0-0	3	100

Objectives	The objective of this course is to study the Object Oriented Paradigm and implement the features of OOP using C++ in problem solving.
Pre-Requisites	Knowledge of basic C programming, analytical, logical, and problem-solving skills are required for this course.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with programming and problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction to Object Oriented Programming: Overview of Procedural vs. Object-Oriented Programming, OOP concepts: Class, Object, Encapsulation, Inheritance, Polymorphism, Abstraction, Benefits of OOP, Introduction to C++: Overview, C++ vs. C, Basic C++ syntax, Tokens, Keywords, Data Types, String, Identifiers and Literals, Operators & Expressions in C++, Scope resolution operator, I/O statements, Decision making, Looping.	9 Hours
Module-2	Functions: Definition, Prototyping, Recursion, Inline functions, Default & constant arguments, Function overloading; Operator functions; Classes & Objects: Class Declaration, Data members & Member functions, Static members & static member functions, passing object to functions & returning objects, Constructors: Default, Parameterized, Copy constructor, Constructor overloading, Destructors, Access Specifiers, Friend functions.	9 Hours
Module-3	Arrays: Array of objects, passing arrays to functions, Arrays as class members; Pointers: Concepts of pointer, Dynamic Memory Allocation and Deallocation, Call by value, Call by reference, pointer to objects, this pointer; Inheritance: Basics of Inheritance, Types of Inheritance - Single, Multiple, Multilevel, Hierarchical, Hybrid, Ambiguity in multipath inheritance, virtual & pure virtual functions, Abstract Classes, Function overriding, Constructors and Destructors in derived class.	10 Hours
Module-4	Exception Handling: Basics of Exception Handling, throw & catch mechanisms, overloading catch block & default catch block; File Handling: Reading & writing into files, File modes, Error handling in files, Binary files and random access to the files.	7 Hours
Module-5	Templates: Function Templates, Class Templates, overloading of function template, multiple parameters in function templates, member function templates; Standard Template Library (STL): Components of STL, containers, algorithms, iterators, application of STL.	7 Hours
Total		42 Hours

Text Books:

- T1. E. Balagurusamy, *Object Oriented Programming with C++*, 8th Ed., McGraw-Hill Education, 2020.
 T2. B. Stroustrup, *The C++ Programming Language*, 4th Ed., Addison-Wesley, 2013.

Reference Books:

- R1. R. Lafore, *Object Oriented Programming with C++*, 4th Ed., SAMS Publishing, 2002.
 R2. H. Schildt, *C++: The Complete Reference*, 4th Ed., McGraw-Hill Education, 2017.
 R3. R. Lischner, *C++ in a Nutshell*, 1st Ed., O'Reilly Media, 2003.

Online Resources:

1. <https://nptel.ac.in/courses/106105151>: by P. P. Das, IIT Kharagpur
2. <https://nptel.ac.in/courses/106105234>: by P. P. Das, IIT Kharagpur
3. <https://nptel.ac.in/courses/106101208>: by A. G. Ranade, IIT Bombay

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Write basic C++ programs using decision making and looping constructs.
CO2	Define classes with data & function members, multiple constructors, and friend functions.
CO3	Implement dynamic memory allocation, inheritance and polymorphism in C++ programs.
CO4	Use exception handling to handle run-time error and files to store & retrieve data.
CO5	Apply generic programming using templates & use the standard template library.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	3	2			2	3	3	2
CO2	3	3	3	2	2	2	2			3	3	3	3
CO3	3	3	2	2	2	3	2			3	3	3	3
CO4	3	3	3	2	2	3	2			3	3	3	3
CO5	3	3	3	2	2	3	3			3	3	2	3

Category	Code	Interactive Web Development	L-T-P	Credits	Marks
PCR	CS2021		3-0-0	3	100

Objectives	The objectives of this course are to learn creating dynamic interactive web pages using JavaScript, DHTML, AJAX, and XML technologies.
Pre-Requisites	Knowledge on HTML, CSS, and programming fundamentals is required.
Teaching Scheme	Regular classroom lectures with the use of ICT as and when required; sessions are planned to be interactive with focus on designing and programming activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: Overview of Web Technologies, Static vs Dynamic Web Pages, DHTML - Components of DHTML (HTML, CSS, DOM, Scripting Languages), Overview of JavaScript and its role in DHTML; Adding JavaScript to HTML, Linked Scripts in HTML, JavaScript Pseudo-URL; Static vs Dynamic Data Type, Differentiating Type Safe and Type Unsafe; Data Types - Basic (Dynamic Typing); Variables: let, const, var; Operators, Expressions, and Statements.	8 Hours
Module-2	Data Types: Composite Types (Array and Objects), Fundamentals of Objects, Generic and User-Defined Objects, Array, Boolean, Date, Math, String, and Type-Related Objects, Type Conversion; Functions: Function Basics, Functions as Objects, Recursive Functions; Object-Oriented JavaScript: Constructors, Prototypes, Class Properties, Inheritance via the Prototype Chain, Overriding Properties; Regular Expressions and RegExp Object.	10 Hours
Module-3	DOM & Event Handling: The Document Object; Standard Document Object Model, Document Trees, Basic Event Models, DOM Event Model, Animations and Effects, DHTML - DOM and HTML, DOM and CSS, Oriented Object Model; Windows and Frames - Dialogs, Opening and Closing Generic Windows, Controlling Windows, Window Events.	9 Hours
Module-4	Building Interactivity: Basic Document Methods, Accessing Specific HTML Element Properties; Form Handling: Basics, Form Fields, Form Validation, Form Usability and JavaScript, Dynamic Forms, DHTML: Images, Rollover Buttons; Navigation: DHTML Menus; Cookies, DOM Storage; AJAX & jQuery.	8 Hours
Module-5	XML: Introduction, XML Document, XML Elements, XML Attributes; Well-Formed XML, XML Usage, Valid XML: DTD, Declaring Simple and Compound Element in XML, Occurrences of an Element under Another Element, Elements with any Content, Elements with either-or Content, Declaring Mixed Content, Declaring Attributes for an Element, Displaying XML.	7 Hours
Total		42 Hours

Text Books:

- T1. T. A. Powell and F. Schneider, *JavaScript: The Complete Reference*, 3rd Ed., McGraw-Hill, 2012.
- T2. J. Dean, *Web Programming with HTML5, CSS, and JavaScript*, 1st Ed., Jones & Bartlett, 2018.
- T3. H. Williamson, *XML: The Complete Reference*, Indian Edition, McGraw-Hill, 2001.

Reference Books:

- R1. D. Goodman, *JavaScript & DHTML Cookbook: Solutions & Examples for Web Programmers*, 1st Ed., O'Reilly Media, 2007.
- R2. A. Ranjan, A. Sinha, and R. Battewad, *JavaScript for Modern Web Development*, BPB Publication, 2020.
- R3. E. T. Ray, *Learning XML*, 2nd Ed., O'Reilly Media, 2003.

Online Resources:

1. <https://www.w3schools.com/js/>
2. <https://www.javatpoint.com/dhtml>
3. <https://www.geeksforgeeks.org/javascript/>
4. <https://www.w3schools.com/jquery/default.asp>
5. <https://www.w3schools.com/xml/>

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

CO1	Incorporate client-side scripting using JavaScript in web pages.
CO2	Apply the features of JavaScript for client side scripting.
CO3	Manage events, windows, and manipulate DOM to create interactive web pages.
CO4	Validate forms, manipulate HTML elements, enhance navigation, and interactivity with user.
CO5	Understand XML syntax, implement and validate an XML document using DTD.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	1				2	1		
CO2	3	3	3	2	3	1				3	2	1	
CO3	2	3	3	1	3	1				3	3	2	1
CO4	2	3	3	1	3	1				3	3	2	2
CO5	3	3	3	1	3	1				3	3	3	3

Category	Code	Data Structures Using C Lab	L-T-P	Credits	Marks
PCR	CS2018		0-0-4	2	100

Objectives	Develop skills to design and analyze simple linear and nonlinear data structures, strengthening the ability of students to identify and apply the suitable data structure for the given real-world problem.
Pre-Requisites	Knowledge of programming in C, specifically on structures, pointers, functions, recursion are required.
Teaching Scheme	Regular laboratory classes conducted under supervision of the teacher. The experiments shall comprise programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Operations on arrays – insert, delete, merge.
2	Selection Sort, Bubble sort.
3	Linear Search and Binary search.
4	Representation of sparse matrix.
5, 6	Addition and transpose of sparse matrix.
7	Implementation of stack using array.
8	Conversion of infix to postfix expression.
9	Evaluation of postfix expression.
10	Operations of the queue using arrays.
11	Operations of a circular queue.
12, 13	Single linked list operations.
14, 15	Double linked list operations.
16	Circular linked list operations.
17	Stack using linked list.
18	Queue using linked list.
19	Polynomial addition using linked-list.
20, 21	Binary Search Tree operations.
22, 23	Graph traversal (BFS, DFS).
24	Warshall's shortest path algorithm.
25, 26	Implementation Insertion Sort and Quicksort.
27, 28	Implementation of Merge Sort and HeapSort.

Text Books:

- T1. M. Weiss, *Data Structures and Algorithm Analysis in C*, 2nd Ed., Pearson Education, 2002.
T2. E. Horowitz, S. Sahni, and S. Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Ed., Universities Press, 2008.

P.T.O

Reference Books:

- R1. A. K. Rath and A. K. Jagadev, *Data Structures Using C*, 2nd Ed., Scitech Publication, 2011.
 R2. Y. Kanetkar, *Data Structures Through C*, 2nd Ed., BPB Publication, 2003.

Online Resources:

1. <https://nptel.ac.in/courses/106106127>: By Prof. H. A. Murthy, et al., IIT Madras
2. <https://nptel.ac.in/courses/106102064>: By Prof. N. Garg, IIT Delhi
3. <https://nptel.ac.in/courses/106106130>: By Dr. N. S. Narayanaswamy, IIT Madras
4. <https://nptel.ac.in/courses/106106133>: By Prof. H. A. Murthy, et al., IIT Madras

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Implement various operations on array and Sparse matrix.
CO2	Design functions to implement basic operations on stack and Queue. Apply the concept of stack and queue for solving real world problems.
CO3	Implement various operations of single, double and circular linked list and apply them in various applications.
CO4	Construct binary search tree and perform traversal, insertion, deletion, and search operations.
CO5	Perform BFS and DFS traversal in a graph and implement various sorting and searching algorithms.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	1		1			1	3	2	3
CO2	2	2	3	2	1		1			1	3	2	3
CO3	2	2	3	2	1		1			1	3	2	3
CO4	2	2	2	3	1		1			1	3	2	3
CO5	2	2	3	3	1		1			1	3	2	3

Category	Code	Object Oriented Programming in C++ Lab	L-T-P	Credits	Marks
PCR	CS2020		0-0-2	1	100

Objectives	The objective of this course is to get a hands on exposure on implementing object oriented concepts and experiment with the features of OOP using the C++ language.
Pre-Requisites	Knowledge of programming in C, specifically on structures, pointers, functions, recursion are required.
Teaching Scheme	Regular laboratory classes conducted under supervision of the teacher. The experiments shall comprise programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Compilation and execution of simple C++ programs.
2	Programs on data type and variables.
3	Programs using various operators available in C++.
4	Programs on decision making and branching.
5	Programs on loops and nested loops.
6	Programs on function overloading.
7	Programs on classes and objects.
8	Programs on constructors & destructors.
9	Programs on friend functions.
10	Programs on operator overloading.
11, 12	Programs on recursion, static methods.
13, 14	Programs on arrays within object & array of objects.
15, 16	Programs on Pointers to objects, call by reference.
17, 18	Programs on inheritance.
19	Programs on function overriding and virtual functions.
20, 21	Programs on abstract class.
22, 23	Programs on Exception handling.
24, 25	Programs on class templates and function templates.
26, 27	Programs on containers, algorithms, iterators.
28	Programs on file handling.

Text Books:

- T1. E. Balagurusamy, *Object Oriented Programming with C++*, 8th Ed., McGraw-Hill Education, 2020.
T2. B. Stroustrup, *The C++ Programming Language*, 4th Ed., Addison-Wesley, 2013.

P.T.O

Reference Books:

- R1. R. Lafore, *Object Oriented Programming with C++*, 4th Ed., SAMS Publishing, 2002.
 R2. H. Schildt, *C++: The Complete Reference*, 4th Ed., McGraw-Hill Education, 2017.
 R3. R. Lischner, *C++ in a Nutshell*, 1st Ed., O'Reilly Media, 2003.

Online Resources:

1. <https://nptel.ac.in/courses/106105151>: by P. P. Das, IIT Kharagpur
2. <https://nptel.ac.in/courses/106105234>: by P. P. Das, IIT Kharagpur
3. <https://nptel.ac.in/courses/106101208>: by A. G. Ranade, IIT Bombay

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Write basic C++ programs using decision making and looping constructs.
CO2	Define classes with data & function members, multiple constructors, and friend functions.
CO3	Implement dynamic memory allocation, inheritance and polymorphism in C++ programs.
CO4	Use exception handling to handle run-time error and files to store & retrieve data.
CO5	Apply generic programming using templates & use the standard template library.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	3	2			2	3	3	2
CO2	3	3	3	2	2	2	2			3	3	3	3
CO3	3	3	2	2	2	3	2			3	3	3	3
CO4	3	3	3	2	2	3	2			3	3	3	3
CO5	3	3	3	2	2	3	3			3	3	2	3

Category	Code	Interactive Web Development Lab	L-T-P	Credits	Marks
PCR	CS2022		0-0-2	1	100

Objectives	The objective of this laboratory course is to provide hands-on exercise on designing attractive and multimedia enriched semantic web pages using JavaScript, DHTML, and XML including creating user-friendly responsive layouts.
Pre-Requisites	Knowledge on HTML and CSS is required for this course. The experiments shall go along with the topics taught in the theory course.
Teaching Scheme	Regular laboratory classes with the use of ICT whenever required; the experiments shall comprise of designing and programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Creating a simple web page by using basic HTML and CSS.
2	Adding JavaScript to HTML (inline, internal, and external scripts), Pseudo-URLs.
3	Programs with variables, static & dynamic data types, operators, expressions.
4	Arrays and objects in JavaScript (Boolean, Date, Math, and String), type conversion.
5	Writing functions in JavaScript, functions as objects, recursive functions.
6	Programming for DHTML (HTML, CSS, DOM, and scripting languages), creating a basic DHTML page.
7	Creating user-defined objects - constructors, prototypes, properties, inheritance, overriding, regular expressions.
8	Event Handling and DOM Manipulation, creating dynamic animations and effects.
9	Form Handling and Validation; display error messages for invalid form inputs.
10	Changing images on hover and dynamic loading of images based on user actions.
11	Creating rollover buttons and dynamic image, implementing navigation menus.
12	Creating XML document, declaring elements, adding attributes, well-formed XML.
13	Validating XML with DTD, declaring element occurrences, and mixed content.
14	Mini Project.

Text Books:

- T1. T. A. Powell and F. Schneider, *JavaScript: The Complete Reference*, 3rd Ed., McGraw-Hill Education, 2012.
- T2. J. Dean, *Web Programming with HTML5, CSS, and JavaScript*, 1st Ed., Jones & Bartlett Learning, 2018.

Reference Books:

- R1. D. Goodman, *JavaScript & DHTML Cookbook: Solutions & Examples for Web Programmers*, 1st Ed., O'Reilly Media, 2007.
- R2. A. Ranjan, A. Sinha, and R. Battewad, *JavaScript for Modern Web Development*, BPB Publication, 2020.
- R3. E. T. Ray, *Learning XML*, 2nd Ed., O'Reilly Media, 2003.

Online Resources:

1. <https://www.w3schools.com/js/>
2. <https://www.javatpoint.com/dhtml>
3. <https://www.geeksforgeeks.org/javascript/>
4. <https://www.w3schools.com/xml/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Apply JavaScript for developing interactive web pages along with HTML, CSS and DOM.
CO2	Write programs in JavaScript using object-oriented features and regular expressions.
CO3	Implement event handling, DOM manipulation, animations, and window management.
CO4	Validate forms, manipulate HTML elements, enhance navigation, and implement interactivity.
CO5	Understand, design, implement, and validate XML documents.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	1				2	1		
CO2	3	3	3	2	3	1				3	2	1	
CO3	2	3	3	1	3	1				3	3	2	1
CO4	2	3	3	1	3	1				3	3	2	2
CO5	3	3	3	1	3	1				3	3	3	3

Category	Code	Probability & Statistics	L-T-P	Credits	Marks
PCR	MT2006		3-1-0	4	100

Objectives	The objective of this course is to familiarize the perspective engineers with the knowledge and concepts of probability and statistics which are essential to study non-deterministic systems.
Pre-Requisites	Basics of Sets, counting techniques, differential and integral calculus of one variable and coordinate geometry of two and three dimensions.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with focus on problem solving activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Measures of central tendencies, Elementary probability, Conditional probability, Bayes' Rule (related problems only), Random variable, Binomial & Hypergeometric distribution, Mean and variance.	11 Hours
Module-2	The Poisson approximation to Binomial Distribution, Poisson Process, Geometric Distribution & Multinomial Distribution, Continuous random variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Exponential Distribution, Joint Discrete Distribution.	12 Hours
Module-3	Populations and Samples, Sampling Distribution of Mean (σ known), Sampling Distribution of Mean (σ unknown) & Sampling Distribution of Variance; Point Estimation of mean, Interval Estimation of mean, Tests of hypotheses and errors involved, Hypotheses concerning one mean, Inference concerning two mean, Estimation of variance, Hypotheses concerning one variance, Hypotheses concerning two variances.	12 Hours
Module-4	Estimation of Proportions, Hypotheses Concerning proportion (one & several), Analysis of $r \times c$ table (Contingency table), Goodness of fit.	10 Hours
Module-5	The method of least squares, Inferences based on the least square estimation, Curvilinear Regression, Checking the adequacy of the model, Correlation, Analysis of Variance, General principle, Completely Randomized Design, Randomized Block Design.	11 Hours
Total		56 Hours

Text Books:

T1. R. A. Johnson, *Probability and Statistics for Engineers*, 8th Ed., PHI Learning, 2011.

Reference Books:

- R1. W. Mendenhall, R. J. Beaver, and B. M. Beaver, *Probability and Statistics*, 14th Ed., Cengage Learning, 2014.
- R2. R. E. Walpole, R. H. Myers, S. L. Myers and K. E. Ye, *Probability & Statistics for Engineers & Scientists*, PHI Learning, 2012.

Online Resources:

1. <https://nptel.ac.in/courses/111105090>: by Prof. S. Kumar, IIT Kharagpur
2. <https://nptel.ac.in/courses/111102160>: by Prof. S. Dharmaraja, IIT Delhi
3. <https://nptel.ac.in/courses/111106415>: by Prof. S. Naqvi, IIT Hyderabad
4. <https://nptel.ac.in/courses/111104644>: by Prof D. Thirumulanathan, IIT Kanpur

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Apply the concepts of probability and random variables to evaluate probabilities of events.
CO2	Apply different discrete and continuous probability models to solve real life problems.
CO3	Apply the concepts of sampling to estimate population parameters and test hypothesis.
CO4	Test the goodness of a model and apply it to real life problems.
CO5	Apply regression model and ANOVA to study the characteristics data sets.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1								2	1	1
CO2	3	2	1		1						2	1	1
CO3	3	3	3	2	1						2	1	1
CO4	3	3	3	2	1						3	2	1
CO5	3	3	3	3	1				1	1	3	2	1

Category	Code	Managerial Economics	L-T-P	Credits	Marks
UCR	MG2004		3-0-0	3	100

Objectives	The objective of the course is to learn the concepts of micro-economics along with tools and techniques to enable the students apply them in making a proper business decision as a manager.
Pre-Requisites	Basic knowledge on money matters and simple mathematical aptitude is required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on real-world examples and problem solving.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: Definition, Nature and scope of Managerial Economics & application of Managerial Economics in Decision making Fundamental Economics Concepts; Theory of Consumption-I: Demand, Law of demand, Demand functions, Demand forecasting and its methods & uses, Elasticity of demand, Theory of supply, Market demand and supply functions and curves, Market equilibrium.	9 Hours
Module-2	Theory of Consumption-II: Indifference Curve analysis, The Price line or Budget Line, Consumer's equilibrium, Income effect, Income consumption curve, Substitution effect, Price effect, Breaking of price effect into income effect and substitution effect, Application of indifference curves in Giffen goods, Wages & labour supply.	8 Hours
Module-3	Production Function & Cost Analysis: Short-run & Long-run production function, Laws of variable proportions & diminishing returns to a factor, Returns to scale, Economies & diseconomies of scale, Estimation of production function - Cobb Douglas production function, Cost analysis, Concepts of economic & accounting cost, Short-run & long-run cost function and curves, Opportunity cost, Concept of revenue.	8 Hours
Module-4	Theory of Product Pricing: Objectives of firms, Profit maximization & sales maximization, Market forms - Perfect competition, Price determination under perfect competition, Firm's equilibrium under perfect competition, Monopoly, Monopolistic competition, Oligopoly and Duopoly, Mark-up pricing, Break even analysis.	9 Hours
Module-5	National Income and Business Cycles: Definition, Concepts of national income, Measuring the national income in India, Importance of national income analysis, National income and economic welfare; Business Cycles – Meaning, Phases, Types, Characteristics, Causes, Control measures.	8 Hours
Total		42 Hours

Text Books:

- T1. D. N. Dwivedi, *Managerial Economics*, 7th Ed., Vikas Publishing House, 2009.
- T2. D. M. Mithani, *Managerial Economics: Theory & Applications*, 8th Ed., Himalaya Publishing House, 2017.

T3. D. Salvator and S. K. Rastogi, *Managerial Economics: Principles and Worldwide Applications*, 9th Ed., Oxford University Press, 2020.

Reference Books:

- R1. C. H. Peterson, W. C. Lewis, and S. K. Jain, *Managerial Economics*, 4th Ed., Pearson Education, 2008.
 R2. Geethika, P. Ghosh, P. R. Chaudhary, *Managerial Economics*, 3rd Ed., McGraw-Hill Education, 2008.
 R3. A. Koutsoyiannis, *Modern MicroEconomics*, 2nd Ed., Palgrave Macmillan, 2003.

Online Resources:

1. <https://nptel.ac.in/courses/110101149>: by Prof. T. Mishra, IIT Bombay
2. https://ddceutkal.ac.in/Syllabus/MCOM/Managerial_Economics.pdf

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Describe the principles of managerial economics and demand vs. supply.
CO2	Explain the theory of consumption through indifference curve analysis.
CO3	Apply the concept of production functions and perform cost analysis.
CO4	Recognize market structures and apply methods for profit maximization.
CO5	Describe the concept of national income and nature of business cycles.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3						3		3	1		1	2
CO2	1						2		2	1		1	2
CO3	3						3		3	2		2	3
CO4	3						3		3	2		2	
CO5	1						1		1	1		2	2

Category	Code	Java Programming	L-T-P	Credits	Marks
PCR	CS2023		3-1-0	4	100

Objectives	The objective of this course is to introduce the key concepts of object-oriented programming (OOP) using Java as the programming language.
Pre-Requisites	Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course. Prior experience with C++ will be beneficial.
Teaching Scheme	Regular classroom lectures with the use of ICT as and when required; sessions are planned to be interactive with problem-solving and programming activities.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: Java Overview, Java Virtual Machine (JVM), Data types, Operators, Conditionals, Control statements, Arrays, Class fundamentals; Object Oriented Concepts: Object oriented systems development life-cycle, Java buzzwords, Objects, Methods, Constructors, Overloading.	12 Hours
Module-2	Inheritance: Basics of Inheritance, Types, Using super and final keyword, Method overriding, Abstract classes, Defining and importing packages, Access specifiers, Interface.	10 Hours
Module-3	Exception handling: Exception fundamentals, types, understanding different keywords (try, catch, finally, throw, throws), User defined exception handling; Threads: thread model, use of Thread class and Runnable interface, thread synchronization, multithreading, inter thread communication.	12 Hours
Module-4	Input/Output: Files, Stream classes, Reading console input; String manipulation: Basics of string handling, String class, StringBuilder, StringBuffer, String Tokenizer.	10 Hours
Module-5	GUI Programming: Working with windows, Frames, Graphics, Color, and Font; Swing fundamentals; Event handling: Delegation event model, Event classes, Sources, Listeners; Introduction to Collection framework.	12 Hours
Total		56 Hours

Text Books:

- T1. J. Keogh, *J2EE: The Complete Reference*, 11th Ed., McGraw-Hill Education, 2017.
 T2. Y. D. Liang, *Introduction to Java Programming*, 9th Ed., Pearson Education, 2012.

Reference Books:

- R1. B. Bates and K. Sierra, *Head First Java*, 2nd Ed., O'Reilly Media, 2005.
 R2. R. N. Rao, *Core Java: An Integrated Approach*, 5th Ed., DreamTech Press, 2016.
 R3. T. Budd, *An Introduction to Object-Oriented Programming*, 3rd Ed., Pearson Education, 2009.
 R4. I. Horton, *Beginning Java*, 7th Ed., Wrox Publications, 2011.

Online Resources:

- <https://nptel.ac.in/courses/106105191>: Prof. D. Samanta, IIT Kharagpur
- <https://docs.oracle.com/javase/tutorial/>

3. <http://www.javatpoint.com/java-tutorial>
4. <http://www.w3schools.in/java/>
5. <https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/>

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

CO1	Apply object-oriented principles to develop Java programs for real life applications.
CO2	Employ inheritance techniques for developing reusable software.
CO3	Develop robust & concurrent programs using exception handling and multi-threading.
CO4	Design programs using I/O operations, and use string classes.
CO5	Design user-friendly GUI applications using Java Swing.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2				2	2	1	3
CO2	3	3	3	2	1	3	1			2	2	1	3
CO3	3	3	3	2	1	3	1			2	2	1	3
CO4	3	2	2	2	1	2	2			2	2	1	3
CO5	3	3	2	2	1	3	2			2	2	1	3

Category	Code	Design & Analysis of Algorithms	L-T-P	Credits	Marks
PCR	CS2002		3-1-0	4	100

Objectives	The objective of this course is to study the classic algorithms in various domains, techniques for designing efficient algorithms, apply algorithm design techniques to solve complex problems, and analyze the complexities of the solutions.
Pre-Requisites	Knowledge of Discrete Mathematics and Data Structures is required.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required; sessions are planned to be interactive with focus on problem solving & analysis.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction, Definition, Characteristics of algorithms, Growth of functions, Asymptotic analysis, Standard notations and common functions, Recurrences, Solution of recurrences by iterative, Substitution, Recursion tree and Master method; Algorithm design techniques, Divide and conquer strategy: Merge Sort, Quick Sort.	12 Hours
Module-2	Heaps, Types of Heap, Maintaining the heap property, Building a Heap, The Heap-sort algorithm, Priority Queue; Dynamic Programming: Matrix chain multiplication, Longest Common Subsequence, Assembly-Line Scheduling, Travelling Salesman Problem.	11 Hours
Module-3	Greedy Algorithms: Activity selection problem, Fractional Knapsack problem, Huffman codes; Branch & Bound techniques: Travelling Salesman Problem, 0-1 Knapsack Problem; Backtracking: N-Queens Problem, Graph Coloring Problem; Data structure for disjoint sets, Disjoint set operations.	11 Hours
Module-4	Graph Traversal Algorithms: Breadth-first and Depth-first search; Minimum spanning trees: Kruskal and Prim's algorithms; Single source shortest path algorithms: Bellman-Ford, Dijkstra, All-pair shortest path algorithm: Floyd-Warshall; Transitive closure of a directed graph; Maximum flow problem: Ford-Fulkerson algorithm.	12 Hours
Module-5	String Matching Algorithms: Naive, Rabin-Karp, Knuth-Morris-Pratt algorithm; NP Completeness: Basic Concepts, non-deterministic algorithm; Polynomial time reduction, Computability classes: P, NP, NP complete, NP hard; Satisfiability Problem (3 CNF SAT), Cook's theorem (without proof); Standard NP complete problems: Clique decision problem, Vertex cover and Chromatic number decision problems; Approximation algorithm characteristics.	10 Hours
Total		56 Hours

Text Books:

- T1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, *Introduction to Algorithms*, 3rd Ed., PHI Learning, 2014.
- T2. E. Horowitz, S. Sahni, and S. Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd Ed., University Press, 2015.

T3. J. Kleinberg and É. Tardos, *Algorithm Design*, 1st Ed., Pearson Education, 2013.

Reference Books:

- R1. M. T. Goodrich and R. Tamassia, *Algorithm Design: Foundations, Analysis, and Internet Examples*, 1st Ed., John Wiley & Sons, 2001.
- R2. U. Manber, *Introduction to Algorithms: A Creative Approach*, 1st Ed., Addison-Wesley, 1989.
- R3. S. Sridhar, *Design and Analysis of Algorithms*, 1st Ed., Oxford University Press, 2014.
- R4. G. Sharma, *Design & Analysis of Algorithms*, 4th Ed., Khanna Publishers, 2019.

Online Resources:

1. <https://nptel.ac.in/courses/106106131>: by Prof. M. Mukund, Chennai Mathematical Institute
2. <https://nptel.ac.in/courses/106101060>: by Prof. Ranade, Diwan, and Viswanathan, IIT Bombay
3. <https://nptel.ac.in/courses/106105164>: by Prof. S. Mukhopadhyay, IIT Kharagpur
4. <https://web.stanford.edu/class/archive/cs/cs161/cs161.1138/>
5. <https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/>

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

CO1	Design algorithms, analyze their running time for best, worst, and average-cases, and understand divide & conquer strategy considering quick sort and merge sort as examples.
CO2	Compare Heapsort with other comparison based sorting algorithms and develop dynamic programming algorithms.
CO3	Apply disjoint-set data structure and various algorithm design techniques such as greedy, backtracking, and branch-and-bound in real life problems.
CO4	Model a given engineering problem using graphs and design the corresponding algorithms to solve the problem.
CO5	Compare various pattern matching algorithms, understand NP-Completeness and the need of approximation algorithms.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1				2	3	1	2
CO2	3	2	3	2	1	2				1	3	1	2
CO3	3	3	3	2	1	2				1	3	1	2
CO4	3	2	3	2	1	2				1	3	1	2
CO5	2	2	2	2	1	1				2	3	1	2

Category	Code	Constitution of India	L-T-P	Credits	Marks
UMC	HS2001		2-0-0	0	100

Objectives	The objective of this subject is to provide understanding of the basic concepts of Indian Constitution and various organs created by the constitution including their functions. The course acquaints students with the constitutional design of state structures and institutions, and their actual working over time.
Pre-Requisites	Basic knowledge of Indian history, overall idea on India's political system.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required and each session is planned to be interactive.

Evaluation Scheme

Attendance	Teacher's Assessment	Mid-Term	End-Term	Total
10	20	20	50	100

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction to Indian Constitution, Historical perspective of the constitution of India. Preamble of Indian constitution, Salient features of Indian constitution, Fundamental rights, Fundamental Duties and its legal status, Directive principles of state policy-its importance and Implementation.	8 Hours
Module-2	Federal structure and distribution of legislative and financial powers between the Union and the States, The Union legislature - The Parliament - The Lok Sabha and the Rajya Sabha, Composition, powers and functions, Union executive, President of India (with powers and functions), Vice-President, The Council of Ministers and the Prime Minister - Powers and functions.	6 Hours
Module-3	State Government, The State Legislature - composition, powers and functions, State executive, Governor (with powers and functions).	5 Hours
Module-4	Amendment of the Constitutional Powers and Procedure, Emergency Provisions: National Emergency, President Rule, Financial Emergency. Scheme of the Fundamental Right to Equality Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21. Local Self Government - Constitutional Scheme in India.	5 Hours
Module-5	The Indian Judicial System - the Supreme Court and the High Court's composition, jurisdiction and functions, Judicial review, Judicial activism, independence of Judiciary in India.	4 Hours
Total		28 Hours

Text Books:

- T1. D. D. Basu, *Introduction of Constitution of India*, 22nd Ed., LexisNexis, 2015.
- T2. K. Subas, *An Introduction to India's Constitution and Constitutional Law*, 5th Ed., National Book Trust India, 2011.

Reference Books:

- R1. M. Laxmikanth, *Indian Polity*, 5th Ed., McGraw Hill, 2011.
- R2. P. M. Bakshi, *The Constitution of India*, 14th Ed., Universal Law Publishing Co, 2006.

Online Resources:

1. <https://nptel.ac.in/courses/129106411>: by Prof. S. Bhat, IIT Madras
2. https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf
3. <https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text>
4. https://www.tutorialspoint.com/indian_polity/indian_polity_tutorial.pdf
5. <https://www.careerpower.in/wp-content/uploads/2016/03/SSC-POLITY-CIVICS-CAPSULE-2016.pdf>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Describe the Indian constitution and to analyze the legalities and related issues of drafting, adoption and enforcement of the Indian Constitution as a fundamental law of the nation and the provisions and privileges of Indian Citizenship.
CO2	Analyze the major dimensions of Indian Political System and to contribute in protecting and preserving the sovereignty and integrity of India.
CO3	Know the successful functioning of democracy in India and to respect the Constitutional Institutions like Judiciary, Executive and Legislature.
CO4	Understand their obligations, responsibilities, privileges & rights, duties and the role that they have to play in deciding the Administrative Machinery of the country.

Program Outcomes Relevant to the Course:

PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO9	Ability to understand the impact of system solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1			2			2	1		1	1			
CO2			2			2	1		2	2			
CO3			2			2	2		1	1		1	
CO4			2			2	2		2	2		1	
CO5			1			3	2		3	1		1	1

Category	Code	Java Programming Lab	L-T-P	Credits	Marks
PCR	CS2024		0-0-4	2	100

Objectives	The objective of the course is to apply object oriented programming principles and implement object oriented programming using Java programming language.
Pre-Requisites	Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course. Prior experience with any other object oriented programming language will be beneficial.
Teaching Scheme	Regular laboratory classes with the use of ICT whenever required, demonstration through practical simulation of code using IDE.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Understanding Java platform, compilation, and execution of a java program.
2	Overview and familiarization with Eclipse IDE for Java programming.
3	Use of class, data types, operators.
4	Use of control statements and conditionals.
5	Implement class, object.
6 - 7	Implementation of constructor, methods and use of OOP features.
8 - 10	Use of Inheritance Types, constructor, inheritance and super keyword, method overriding and use of final.
11	Practical use of abstract class.
11	Using Interface, Achieving multiple inheritance.
12	Implementation of package.
13 - 15	Exception handling fundamentals and java built-in exceptions, use of Scanner class for console input, Use of own Exception subclass.
16 - 18	Thread priority, implementation of synchronization and Implementation of user-defined thread.
19	I/O Basics, byte stream and character streams, reading and writing files.
20	Text processing using Java pre-defined StringBuilder and String Buffer classes.
21 - 24	GUI basics and Window fundamentals, working with different Components, Working with Container and Layout Managers, Event handling for interactive GUI application.
25 - 28	Project work on designing and developing a GUI based application.

Text Books:

- T1. J. Keogh, *J2EE: The Complete Reference*, 11th Ed., McGraw-Hill Education, 2017.
T2. Y. D. Liang, *Introduction to Java Programming*, 9th Ed., Pearson Education, 2012.

Reference Books:

- R1. B. Bates and K. Sierra, *Head First Java*, 2nd Ed., O'Reilly Media, 2005.
R2. T. Budd, *An Introduction to Object-Oriented Programming*, 3rd Ed., Pearson Education, 2009.
R3. I. Horton, *Beginning Java*, 7th Ed., Wrox Publications, 2011.

Online Resources:

1. <https://nptel.ac.in/courses/106105191>: Prof. D. Samanta, IIT Kharagpur
2. <https://docs.oracle.com/javase/tutorial/>
3. <http://www.javatpoint.com/java-tutorial>
4. <http://www.w3schools.in/java/>
5. <https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Apply object oriented principles to write Java programs for real-life applications.
CO2	Employ inheritance techniques for developing reusable software.
CO3	Develop robust & concurrent programs using exception handling and multi-threading.
CO4	Design programs using I/O operations, string classes, and collection framework.
CO5	Design GUI-based applications using Swing with database connectivity.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO6	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1				1	3	1	2
CO2	3	3	3	2	1	2				2	2	2	2
CO3	3	3	3	2	1	3				2	2	2	2
CO4	3	3	2	3	1	3				3	3	2	2
CO5	3	3	3	3	1	3				3	3	2	2

Category	Code	Design & Analysis of Algorithms Lab	L-T-P	Credits	Marks
PCR	CS2005		0-0-2	1	100

Objectives	The objective of this course is To implement various algorithms under different categories, analyze algorithms & their complexities, and implement string matching algorithms.
Pre-Requisites	Basic knowledge of C Programming and Data Structures is required.
Teaching Scheme	Regular laboratory classes conducted under supervision of the teacher. The experiments shall comprise of programming assignments.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	Sorting: Selection, Bubble and Insertion Sort
2	Implementation of Quick Sort
3	Implementation of Merge Sort
4	Implementation of Heap Sort
5	Matrix chain multiplication
6	Longest common subsequence
7	Fractional and 0/1 Knapsack Problem
8	Graph Traversal using BFS and DFS
9	Dijkstra's single source shortest path algorithm
10	Floyd Warshall's all pair shortest path algorithm
11	Kruskal's algorithm for Minimum Spanning Tree
12	Prim's Algorithm for Minimum Spanning Tree
13	N-queen's problem using backtracking
14	Naive and Rabin-Karp string matching algorithm

Text Books:

- T1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, *Introduction to Algorithms*, 3rd Ed., PHI Learning, 2014.
- T2. A. Levitin, *Introduction to the Design and Analysis of Algorithms*, 3rd Ed., Pearson, 2012.

Reference Books:

- R1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, *Data Structures and Algorithms*, 3rd Ed., Pearson Education, 2006.
- R2. D. E. Knuth, *The Art of Computer Programming - Volumes 1 & 3*, Pearson Education, 2009.
- R3. S. S. Skiena, *The Algorithm Design Manual*, 2nd Ed., Springer, 2008.

Online Resources:

1. <https://nptel.ac.in/courses/106101060>: by Prof. Ranade, Diwan, and Viswanathan, IIT Bombay
2. <https://nptel.ac.in/courses/106106131>: by Prof. M. Mukund, Chennai Mathematical Institute
3. http://www.cs.virginia.edu/~robins/CS_readings.html
4. <https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/>

Course Outcomes: *At the end of this course, the students will be able to:*

CO1	Implement various searching and sorting algorithms and compare their execution time.
CO2	Understand and develop skill to solve problems using divide and conquer strategy.
CO3	Apply greedy, dynamic programming, backtracking and branch and bound paradigms to solve real life problems.
CO4	Formulate real life problems and solve them using different graph algorithms.
CO5	Implement and compare various pattern matching algorithms such as Naive, Rabin-Karp etc.

Program Outcomes Relevant to the Course:

PO1	Apply knowledge of computing fundamentals, mathematics and domain knowledge appropriate for computing models from defined problems and requirements.
PO2	Design and develop applications to analyze and solve all computer science related problems.
PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO5	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1	2		2			2	3	1	3
CO2	3	3	2	2	2		2			1	3	1	3
CO3	3	3	3	2	2		3			2	3	1	2
CO4	3	3	3	1	2		2			1	3	1	2
CO5	3	2	2	1	1		1			1	3	1	2

Category	Code	Soft Skills & Technical Writing Lab	L-T-P	Credits	Marks
SEC	HS2002		0-0-4	2	100

Objectives	The objectives of this laboratory course are to impart important soft skills and to hone technical writing skills for developing research acumen and prepare the students to perform better in recruitment drives.
Pre-Requisites	Basic knowledge of English grammar and the ability to speak, read and write using the English language is required.
Teaching Scheme	Regular laboratory classes with various tasks designed to facilitate communication through pair and/or team activities with regular assessments, presentations, discussions, role play, audio-visual supplements, writing activities, business writing practices & vocabulary enhancement.

Evaluation Scheme

Attendance	Daily Performance	Lab Record	Lab Test / Project	Viva-voce	Total
10	30	15	30	15	100

Detailed Syllabus

Experiment-#	Assignment/Experiment
1	GD input and discussion.
2	Mock GD 1: content development.
3	Mock GD 2: group behaviour.
4	GD test and evaluation.
5	Presentation skills: review.
6-9	Delivering PowerPoint Presentations.
10	Writing an effective resume.
11	Writing a covering letter.
12	Personal Interviews: FAQs.
13-14	Mock Personal Interviews.
15	Reports: Importance, types, format and language.
16	Business Report: letter of transmittal.
17	Business Report: executive summary.
18	Business Proposals: importance, types, format.
19-20	Exercises on writing a proposal.
21	Features of research writing.
22	Elements of style in research writing.
23	Preparing works cited list as per MLA/APA.
24	Dealing with plagiarism.
25	The art of paraphrasing.
26-28	Group project presentation.

Text Books:

- T1. M. A. Rizvi, *Effective Technical Communication*, 2nd Ed., McGraw-Hill Education, 2017.
- T2. S. John, *The Oxford Guide to Writing and Speaking*, 3rd Ed., Oxford University Press, 2013.

Reference Books:

- R1. B. K. Das, K. Samantray, R. Nayak, S. Pani, and S. Mohanty, *An Introduction to Professional English and Soft Skills*, Cambridge University Press, 2009.
- R2. B. K. Mitra, *Communication Skills for Engineers*, Oxford University Press, 2011.
- R3. The Modern Language Association of America, *MLA Handbook*, 9th Ed., MLA, 2021.
- R4. D. S. Hegde (Ed), *Essays on Research Methodology*, Springer, India, 2015.
- R5. D. Ridley, *The Literature Review: A Step-by-Step Guide for Students*, 2nd Ed., Sage Publications, 2012.

Online Resources:

1. <https://nptel.ac.in/courses/109104107/>
2. <https://nptel.ac.in/courses/109104031/>
3. <https://purdueglobalwriting.center/argumentative-writing/>
4. <https://caw.ceu.edu/online-writing-resources>
5. <https://communicationmgmt.usc.edu/blog/corporate-communication-resources/>
6. <https://owl.purdue.edu/owl/purdueowl.html>
7. <https://www.usingenglish.com/>
8. <http://www.english-test.net>
9. <https://www.ef.com/wwen/english-resources/>

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

CO1	Understand and practice vital soft skills for professional success.
CO2	Participate well in the recruitment process successfully.
CO3	Understand aspects of public speaking and make impactful multimedia presentations.
CO4	Compose compelling resumes and persuasive cover letters.
CO5	Hone technical writing skills and get introduced to research writing.

Program Outcomes Relevant to the Course:

PO3	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.
PO4	Analyze and review literature to invoke the research skills to design, interpret and make inferences from the resulting data.
PO7	Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills.
PO8	Communicate effectively and present technical information in oral and written reports.
PO10	Appreciate the importance of goal setting and to recognize the need for life-long learning.

Mapping of COs to POs and PSOs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1			1	3			3	3		3	1	1	1
CO2			1	1			3	3		3	1	1	1
CO3			2	3			3	3		3	1	1	1
CO4							3	3		3	1	1	1
CO5			3	3			3	3		3	1	1	1



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