SCHOOL OF COMPUTING

(AMRITAPURI, CHENNAI, COIMBATORE)

Curriculum and Syllabi

B Tech - Computer Science and Engineering (Cyber Security)

(BTC-CYS)

2024

GENERAL INFORMATION

ABBREVIATIONS USED IN THE CURRICULUM

Cat	-	Category
L	-	Lecture
T	-	Tutorial
P	-	Practical
Cr	-	Credits
ENGG	-	Engineering Sciences (including General, Core and Electives)
HUM	-	Humanities (including Languages and others)
SCI	-	Basic Sciences (including Mathematics)
PRJ	-	Project Work (including Seminars)
AES	-	Aerospace Engineering
AIE	-	Computer Science and Engineering - Artificial Intelligence
BIO	-	Biology
CCE	-	Computer and Communication Engineering
CHE	-	Chemical Engineering
CHY	-	Chemistry
CSE	-	Computer Science and Engineering
CVL	-	Civil Engineering
CUL	-	Cultural Education
CYS	-	Cyber Security
EAC	-	Electronics and Computer Engineering
ECE	-	Electronics and Communication Engineering
EEE	-	Electrical and Electronics Engineering
ELC	-	Electrical and Computer Engineering
HUM	-	Humanities.
MAT	-	Mathematics
MEE	-	Mechanical Engineering
PHY	-	Physics

Course Outcome (CO) – Statements that describe what students are expected to know and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Program Outcomes (POs) – Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the Program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

Program Objectives

The B Tech program in CSE (Cyber Security) is intended to mould students into well prepared Cyber Security professionals and has been designed with a good balance between theoretical & practical aspects, analytical and architectural methods complemented by academic research and industry best practices.
Through this program students acquire necessary theoretical background, insights into general and technical aspects of Cyber Security, a good understanding of analytical methods and management practices in the field.

Program Educational Objectives (PEOs)

The PEOs outlined below describe the expectations of what graduates will accomplish in their careers, and how they perform during the first few years after graduation.

Areas or fields where graduates can find employment: Hundreds of Cyber Security career roles in pretty much every vertical market in the industry.

Preparedness of graduates to take up higher studies: There are various tracks with ample funding to take up masters and subsequently PhD programs around the world.

- Find employment in Computer Science & Engineering and/or Cyber Security field in a professional organization.
- Apply conceptual and practical knowledge of Cyber Security along with tools and technologies to avoid, identify, counter, and recover from cyber threats.
- Communicate Cyber Security risks, threats, and countermeasures to convince decision makers to apply this understanding to develop cyber defense strategies.
- Contribute to product development as individual contributors in corporations and/or entrepreneurs in inter disciplinary fields of computer engineering & technology and Cyber Security.
- Identify, analyze, and utilize professional and academic literature in the field of Cyber Security to help solve problems and stay up to date with the rapidly changing context of global security concerns.

Program Outcomes (PO):

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design and development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

1. Gain a thorough understanding of the Cyber Security landscape with its growing threats and vulnerabilities in the world of computing including software and hardware. Attain skills to comprehend and anticipate future challenges and devise methods to meet them and also, be articulate and skilled to convince all the stakeholders.

2. Acquire and demonstrate the ability to use standard tools, practices and technologies for the analysis, design, development and implementation of innovative and optimal Cyber Security solutions without compromising the privacy needs of individual and entities and the security concerns of law enforcement agencies.

CURRICULUM

SEMESTER I

Cat	Code	Title	L T P	Credit
HUM	23ENG101	Technical Communication	2 0 3	3
CYS	24CYS101	Cyber Security Essentials	2 0 3	3
MAT	24MAT109	Linear Algebra	3 1 0	4
SCI	24PHY105	Modern Physics	2 1 0	3
ENGG	24CYS102	Problem Solving and Algorithmic Thinking	2 0 3	3
ENGG	24CYS103	Principles of Engineering	2 0 3	3
CYS	24CYS104	Computer Hardware and System Essentials	2 0 3	3
HUM	22ADM101	Foundation of Indian Heritage	2 0 1	2
HUM	22AVP103	Mastery Over Mind	1 0 2	2
Total (18 L + 2 T + 17 P = 37 hrs)				26

SEMESTER II

Cat	Code	Title	L T P	Credit
MAT	24MAT118	Discrete Mathematics	3 1 0	4
MAT	24MAT119	Number Theory and Algebra	3 0 0	3
CYS	24CYS111	Digital Signal Processing	2 1 0	3
CYS	24CYS112	Computer Organisation and Architecture	3 0 3	4
CYS	24CYS113	Computer Programming	3 0 0	3
CYS	24CYS181	Computer Programming Lab	0 0 3	1
CYS	24CYS114	Classical Cryptography	3 0 0	3
HUM	22ADM111	Glimpses of Glorious India	2 0 1	2
Total (19L + 2T + 6P = 27 hrs)				23

SEMESTER III

Cat	Code	Title	L T P	Credit
MAT	24CYS201	Optimization Techniques	3 1 0	4
CYS	24CYS202	User Interface Design	1 0 3	2
CYS	24CYS203	Operating Systems	3 0 0	3
CYS	24CYS281	Operating Systems Lab	0 0 3	1
CYS	24CYS204	Advanced Programming	3 0 3	4
CYS	24CYS205	Database Management System	2 0 3	3
CYS	24CYS206	Modern Cryptography	3 0 0	3
HUM	23LSE201	Life Skills for Engineers I	1 0 2	P/F
HUM		Amrita Value Programme I	1 0 0	1
Total (16 L + 1 T + 12 P = 29 hrs)				21

SEMESTER IV

Cat	Code	Title	L T P	Credit
MAT	24CYS211	Probability and Statistics	3 1 0	4
CYS	24CYS212	Multimedia Processing	2 0 3	3
CYS	24CYS213	System Security	3 0 0	3
CYS	24CYS282	System Security Lab	0 0 3	1
CYS	24CYS214	Machine Learning in Cyber Security	2 0 3	3
CYS	24CYS215	Data Structures and Algorithms	3 0 0	3
CYS	24CYS283	Data Structures and Algorithms Lab	0 0 3	1
CYS	24CYS284	Android Application Development	0 0 3	1
HUM		Amrita Value Programme II	1 0 0	1
HUM	23LSE211	Life Skills for Engineers II	1 0 2	2
Total (15 L + 1 T + 18 P = 34 hrs)				22

SEMESTER V

Cat	Code	Title	L T P	Credit
CYS	24CYS301	Digital Communication	3 0 0	3
CYS	24CYS302	Secure Coding	3 0 3	4
CYS	24CYS303	Algorithms: Design and Analysis	3 0 0	3
CYS	24CYS304	Computer Networks	3 0 0	3
CYS	24CYS381	Computer Networks Lab	0 0 3	1
CYS	24CYS305	Artificial Intelligence and Neural Networks	3 0 3	4
HUM		Humanities Elective	2 0 0	2
HUM	23LSE301	Life Skills for Engineers III	1 0 2	2
HUM	23ENV300	Environmental Science		P/F
ENGG	23LIV390***	Live in Labs-I***		[3]
Total (18 L + 0 T + 12 P = 30 hrs)				22+[3]

SEMESTER VI

Cat	Code	Title	L T P	Credit
CYS	24CYS311	Cyber Forensics	2 0 3	3
CYS	24CYS312	Principles of Programming Languages	2 0 3	3
CYS	24CYS313	Network Security	3 0 0	3
CYS	24CYS314	Applied Cryptography	3 1 0	4
CYS	24CYS315	Automata Theory and Compiler Design	3 0 3	4
CYS		Professional Elective – 1	3 0 0	3
HUM	23LSE311	Life Skills for Engineers IV	1 0 2	2
ENGG	23LIV490***	Livein-Labs-II***		[3]
Total (17 L + 1 T + 12 P = 30 hrs)				22+[3]

SEMESTER VII

Cat	Code	Title	L T P	Credit
CYS	24CYS401	Secure Software Engineering	2 0 3	3
CYS	24CYS402	Distributed Systems and Cloud Computing	2 0 3	3
CYS	24CYS403	Web Application Security	2 0 3	3
CYS	24CYS481	Advanced Protocol Engineering and Security Lab	0 0 3	1
CYS		Professional Elective – 2	3 0 0	3
CYS		Professional Elective – 3	3 0 0	3
CYS		Free Elective – 1 (Management Elective)	3 0 0	3
CYS	24CYS498	Project - Phase – 1 / Seminar	0 0 6	2
HUM	23LAW300	Indian Constitution		P/F
		Total (15 L + 0 T + 18 P = 33 hrs)		21

SEMESTER VIII

Cat	Code	Title	L T P	Credit
CYS	24CYS499	Project - Phase – 2	0 0 30	10
Total (0 L + 0 T + 30 P = 30hrs)				10
Total Credits				167

**** Professional Elective - Electives categorised under Engineering, Science, Mathematics, Live-in-Labs, and NPTEL Courses. Student can opt for such electives across departments/campuses. Students with CGPA of 7.0 and above can opt for a maximum of 2 NPTEL courses with the credits not exceeding 8.***

***** Free Electives - This will include courses offered by Faculty of Humanities and Social Sciences/ Faculty Arts, Commerce and Media / Faculty of Management/Amrita Darshanam - (International Centre for Spiritual Studies).***

****** Live-in-Labs - Students undertaking and registering for a Live-in-Labs project, can be exempted from registering for an Elective course in the higher semester.***

PROFESSIONAL ELECTIVES

Cat	Code	Title	L T P	Credit
CYS	24CYS331	Wireless Sensor Network Security	3 0 0	3
CYS	24CYS332	Mobile and Wireless Security	3 0 0	3
CYS	24CYS333	Internet of Things	2 0 3	3
CYS	24CYS334	Program Obfuscation	3 0 0	3
CYS	24CYS335	Vulnerability Assessment and Penetration Testing	3 0 0	3
CYS	24CYS336	Blockchain Technology	2 0 3	3
CYS	24CYS337	Formal Methods for Security	3 0 0	3
CYS	24CYS338	Hardware Security	3 0 0	3
CYS	24CYS339	Biometrics and Security	3 0 0	3
CYS	24CYS340	Quantum Cryptography	3 0 0	3
CYS	24CYS341	Cyber Analytics	3 0 0	3
CYS	24CYS342	Zero-Trust Architecture	3 0 0	3

Electives in Business Systems					
Cat	Code	Title	L T P	Credit	
CYS	24CYS431	Software Project Management	3 0 0	3	
HUM	24CYS432	Financial Engineering	3 0 0	3	
HUM	24MNG431	Financial Management	3 0 0	3	
CYS	24MNG432	Information Security Risk Management	3 0 0	3	

EVALUATION PATTERN

Course Type	Internal : External	Internal		External
L T P	60 : 40	Continuous Assessment	Mid-Term	
X 0 0		30	30	40
X Y 0		30	30	40
X 0 Z		30	30	40
0 0 Z		40	20	40

Amrita Values Programmes I and II

Course Code	Title	L-T-P	Credits
22ADM201	Strategic Lessons from Mahabharatha	1-0-0	1
22ADM211	Leadership from Ramayana	1-0-0	1
22AVP210	Kerala Mural Art and Painting	1-0-0	1
22AVP201	Amma's Life and Message to the modern world	1-0-0	1
22AVP204	Lessons from the Upanishads	1-0-0	1
22AVP205	Message of the Bhagavad Gita	1-0-0	1
22AVP206	Life and Message of Swami Vivekananda	1-0-0	1
22AVP207	Life and Teachings of Spiritual Masters of India	1-0-0	1
22AVP208	Insights into Indian Arts and Literature	1-0-0	1
22AVP213	Traditional Fine Arts of India	1-0-0	1
22AVP214	Principles of Worship in India	1-0-0	1
22AVP215	Temple Mural Arts in Kerala	1-0-0	1
22AVP218	Insights into Indian Classical Music	1-0-0	1
22AVP219	Insights into Traditional Indian Painting	1-0-0	1
22AVP220	Insights into Indian Classical Dance	1-0-0	1
22AVP221	Indian Martial Arts and Self Defense	1-0-0	1
22AVP209	Yoga and Meditation	1-0-0	1

FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS				
Cat.	Course Code	Title	L T P	Credit
HUM	23CUL230	Achieving Excellence in Life - An Indian Perspective	2 0 0	2
HUM	23CUL231	Excellence in Daily Life	2 0 0	2
HUM	23CUL232	Exploring Science and Technology in Ancient India	2 0 0	2
HUM	23CUL233	Yoga Psychology	2 0 0	2
HUM	23ENG230	Business Communication	1 0 3	2
HUM	23ENG231	Indian Thought through English	2 0 0	2
HUM	23ENG232	Insights into Life through English Literature	2 0 0	2
HUM	23ENG233	Technical Communication	2 0 0	2
HUM	23ENG234	Indian Short Stories in English	2 0 0	2
HUM	23FRE230	Proficiency in French Language (Lower)	2 0 0	2
HUM	23FRE231	Proficiency in French Language (Higher)	2 0 0	2
HUM	23GER230	German for Beginners I	2 0 0	2
HUM	23GER231	German for Beginners II	2 0 0	2
HUM	23GER232	Proficiency in German Language (Lower)	2 0 0	2
HUM	23GER233	Proficiency in German Language (Higher)	2 0 0	2
HUM	23HIN230	Hindi I	2 0 0	2
HUM	23HIN231	Hindi II	2 0 0	2
HUM	23HUM230	Emotional Intelligence	2 0 0	2
HUM	23HUM231	Glimpses into the Indian Mind - the Growth of Modern India	2 0 0	2
HUM	23HUM232	Glimpses of Eternal India	2 0 0	2
HUM	23HUM233	Glimpses of Indian Economy and Polity	2 0 0	2
HUM	23HUM234	Health and Lifestyle	2 0 0	2
HUM	23HUM235	Indian Classics for the Twenty-first Century	2 0 0	2
HUM	23HUM236	Introduction to India Studies	2 0 0	2
HUM	23HUM237	Introduction to Sanskrit Language and Literature	2 0 0	2
HUM	23HUM238	National Service Scheme	2 0 0	2
HUM	23HUM239	Psychology for Effective Living	2 0 0	2
HUM	23HUM240	Psychology for Engineers	2 0 0	2
HUM	23HUM241	Science and Society - An Indian Perspective	2 0 0	2

HUM	23HUM242	The Message of Bhagwat Gita	2 0 0	2
HUM	23HUM243	The Message of the Upanishads	2 0 0	2
HUM	23HUM244	Understanding Science of Food and Nutrition	2 0 0	2
HUM	23HUM245	Service Learning	2 0 0	2
HUM	23JAP230	Proficiency in Japanese Language (Lower)	2 0 0	2
HUM	23JAP231	Proficiency in Japanese Language (Higher)	2 0 0	2
HUM	23KAN230	Kannada I	2 0 0	2
HUM	23KAN231	Kannada II	2 0 0	2
HUM	23MAL230	Malayalam I	2 0 0	2
HUM	23MAL231	Malayalam II	2 0 0	2
HUM	23SAN230	Sanskrit I	2 0 0	2
HUM	23SAN231	Sanskrit II	2 0 0	2
HUM	23SWK230	Corporate Social Responsibility	2 0 0	2
HUM	23SWK231	Workplace Mental Health	2 0 0	2
HUM	23TAM230	Tamil I	2 0 0	2
HUM	23TAM231	TAMIL II	2 0 0	2

SYLLABUS

SEMESTER I

23ENG101	TECHNICAL COMMUNICATION	L-T-P-C: 2-0-3-3

Course Objectives

- To introduce the students to the fundamentals of mechanics of writing
- To facilitate them with the style of documentation and specific formal written communication
- To initiate in them the art of critical thinking and analysis
- To help them develop techniques of scanning for specific information, comprehension and organization of ideas
- To enhance their technical presentation skills.

Course Outcomes

CO1: To gain knowledge about the mechanics of writing and the elements of formal correspondence.

CO2: To understand and summarize technical documents.

CO3: To apply the basic elements of language in formal correspondence.

CO4: To interpret and analyze information and to organize ideas in a logical and coherent manner.

CO5: To compose project reports/ documents, revise them for language accuracy and make technical presentations.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3				
CO2				1						2				
CO3										3				
CO4				1						2				
CO5									2	1				

Syllabus

Unit 1

Mechanics of Writing: Grammar rules -articles, tenses, auxiliary verbs (primary & modal) prepositions, subject-verb agreement, pronoun-antecedent agreement, discourse markers and sentence linkers.
General Reading and Listening comprehension - rearrangement & organization of sentences.

Unit 2

Different kinds of written documents: Definitions- descriptions- instructions-recommendations- user manuals - reports – proposals
Formal Correspondence: Writing formal Letters.
Mechanics of Writing: impersonal passive & punctuation
Scientific Reading & Listening Comprehension.

Unit 3

Technical paper writing: documentation style - document editing – proof reading - Organizing and formatting.
Mechanics of Writing: Modifiers, phrasal verbs, tone and style, graphical representation.
Reading and listening comprehension of technical documents.
Mini Technical project (10 -12 pages). Technical presentations

Textbook

Hirsh Herbert L. Essential Communication Strategies for Scientists, Engineers and Technology Professionals. Second Edition, New York: IEEE press; 2002.

Reference(s)

1. *Anderson Paul V. Technical Communication: A Reader-Centred Approach. Fifth Edition, Harcourt Brace College Publication; 2003.*
2. *Strunk, William Jr., White. EB. The Elements of Style. New York, Alliyan & Bacon; 1999.*
3. *Riordan G Daniel, Pauley E Steven. Technical Report Writing Today, Eighth Edition (Indian Adaptation), New Delhi: Biztantra; 2004.*
4. *Michael Swan. Practical English Usage. Oxford University Press; 2000.*

24CYS101	CYBER SECURITY ESSENTIALS	L-T-P-C: 2-0-3-3

Pre-Requisite(s): Nil

Course Objectives:

- Understand the field of digital security and concepts of access control mechanism.
- To introduce keywords and jargons involved in securing browser
- Understanding network basic and familiarize on security of network protocols
- Awareness and understanding on cyber-attacks and data privacy

Course Outcomes:

CO1: Apply a solid foundation in digital security and measures taken to protect device from threats.

CO2: Learning access control mechanism and understand how to protect servers

CO3: Understand the importance of a network basics and brief introduction on security of network protocols

CO4: To understand cyber-attacks and learn data privacy issues and preventive measures

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	2	1		1	3	2			1	2	3	1
CO2		2	2	2		1					1	2	3	1
CO3		1	2	3	2	2		1				2	3	2
CO4		1	3	3	3	3	3	3			1	3	3	3

Syllabus

Unit 1

Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials, keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction,

Unit 2

Networking basics (home network and large-scale business networks), Networking concepts (CIDR, subnets), and protocols (DNS, DHCP, IP). Security of protocols, sample application hosted on-premises.

Unit 3

Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability.

Textbooks

Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.

References:

1. *Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc . 5th Edition, 2015*
2. *Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons, 2018xx LINEAR ALGEBRA*

24MAT109	LINEAR ALGEBRA	L-T-P-C: 3-1-0-4

Prerequisites: Nil

Course Objectives

- Understand the basic concepts of vector space, subspace, basis and dimension.
- Familiar the inner product space. Finding the orthogonal vectors using inner product.
- Understand and apply linear transform for various matrix decompositions.

Course Outcomes

CO1: Solve systems of linear equations and analyze vector properties.

CO2: Apply concepts of vector spaces, inner products, and orthogonality.

CO3: Perform linear transformations, analyze matrices, and understand change of basis.

CO4: Utilize techniques like diagonalization, Jordan/rational forms, and SVD.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											1
CO2	3	3	2											2
CO3	3	3	2											1
CO4	3	2	1											1

Syllabus

Unit 1

System of linear Equations, linear independence. Eigen values and Eigen vectors: Definitions and properties. Positive definite, negative definite and indefinite. Diagonalization and Orthogonal Diagonalization. Properties of Matrices. Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian Matrices and Orthogonal matrices.

Unit 2

Vector spaces - Sub spaces - Linear independence - Basis - Dimension - Inner products - Orthogonality - Orthogonal basis - Gram Schmidt Process - Change of basis.
Orthogonal complements - Projection on subspace - Least Square Principle

Unit 3

Linear Transformations: Positive definite matrices - Matrix norm and condition number - QR- Decomposition - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation. Change of basis, Similarity of linear transformations, Diagonalization and its applications, Jordan form and rational canonical form, SVD.

Textbook

Howard Anton and Chris Rorrs,"Elementary Linear Algebra", Ninth Edition, John Wiley & Sons, 2000.

Reference(s)

1. *D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.*
2. *Gilbert Strang, "Linear Algebra and its Applications", Third Edition, Harcourt College Publishers, 1988.*
3. *Kenneth Hoffman and Ray Kunze, Linear Algebra, Pearsons, 2015.*

24PHY105	MODERN PHYSICS	L-T-P-C: 2-1-0-3

Pre-Requisite(s): Nil

Course Objective

The main objective of the course is to expose to the development of Physics with special emphasis on Quantum mechanics-which enable a computer science engineer to apply this in the field of emerging areas like quantum computing.

Course Outcomes

CO1: To be exposed to the fundamental concepts of Wave nature of Particles and Particle nature of Waves.

CO2: To understand various atomic models and their application to phenomena like spectrum formation including LASERS.

CO3: To be introduced to the basics of Quantum mechanics like Wave function, Operators, States of wave function etc.

CO4: To be able to apply quantum mechanics to simple applications like particle in a box, tunnelling of particle across a barrier etc. Equipment use in water treatment.

CO5: Apply Quantum mechanics in the emerging field of Quantum computing.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2								2		
CO2	3	3	2	2								2		
CO3	3	3	2	3								2		
CO4	3	3	2	3										
CO5	3	3	2	3								2		

Syllabus

Unit 1

Origin of quantum theory of radiation: Black body radiation, photo-electric effect, Compton Effect – pair production and annihilation, De-Broglie hypothesis, description of waves and wave packets, group velocities. Evidence for wave nature of particles: Davisson-Germer experiment, Heisenberg uncertainty principle.

Unit 2

Atomic structure: Historical Development of atomic structures: Thomson’s Model, Rutherford’s Model: Scattering formula and its predictions, Atomic spectra - Bohr’s Model, Sommerfield’s Model, The correspondence principle, nuclear motion, and atomic excitation, Application: Lasers.

Unit 3

Quantum mechanics: Wave function, Probability density, expectation values - Schrodinger equation – time dependent and independent, Linearity and superposition, expectation values, operators, Eigen functions and Eigen values.

Unit 4

Application of 1D Schrodinger Wave equation: Free particle, Particle in a box, Finite potential well, Tunnel effect, Harmonic oscillator.

Unit 5

Intro to Quantum computing- Q bits- II Quantum correlations: Bell inequalities and entanglement, Schmidt decomposition, super dense coding, teleportation, module.

Textbook

Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, "Concepts of Modern Physics" - McGraw Hill Education (Ondia) Private Ltd, Sixth edition, 2009.

Eleanor G. Rieffel and Wolfgang H. Polak, "Quantum Computing, A Gentle Introduction", MIT press

Reference Books

1. *R Shankar, "Principles of Quantum Mechanics", Pearson India (LPE), 2E, 2006.*
2. *L I Schiff, "Quantum Mechanics", TMH, 2E,2010.*

24CYS102	PROBLEM SOLVING AND ALGORITHMIC THINKING	L-T-P-C: 2-0-3-3

Prerequisites: Nil

Course Objectives

- This course provides the foundations of computational problem solving.
- The course focuses on principles and methods thereby providing transferable skills to any other domain.
- The course also provides a foundation for developing computational perspectives of one's own discipline.

Course Outcomes

CO1: Apply algorithmic thinking to understand, define and solve problems.

CO2: Design and implement algorithm(s) for a given problem.

CO3: Apply the basic programming constructs for problem solving.

CO4: Understand an algorithm by tracing its computational states, identifying bugs and correcting them.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1												
CO2	3	2	3		3			3	3	3				
CO3	2	1												
CO4	1	1	2		2									

Syllabus

Unit 1

Problem Solving and Algorithmic Thinking Overview – problem definition, Problem Solving framework - logical reasoning; Algorithm – definition, practical examples, properties, representation, algorithms vs programs.

Unit 2

Algorithmic thinking – Constituents of algorithms – Sequence, Selection and Repetition, input-output; Computation – expressions, logic; Problem Understanding and Analysis – Variables, name binding - Algorithms to programs.

Unit 3

Problem solving with algorithms – Searching and Sorting, Evaluating algorithms, modularization, recursion. Python for problem solving – Introduction, data input, output statements, operators, control structures, data organization: lists, tuples, dictionary, set.

Textbook

Riley DD, Hunt KA. Computational Thinking for the Modern Problem Solver. CRC press; 2014 Mar 27.

Python for Everybody. Author: Charles R. Severance. Publisher: Shroff Publishers. ISBN: 9789352136278.

Reference(s)

1. *Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018.*
2. *Beecher K. Computational Thinking: A beginner's guide to Problem-solving and Programming. BCS Learning & Development Limited; 2017.*
3. *Curzon P, McOwan PW. The Power of Computational Thinking: Games, Magic and Puzzles to help you become a computational thinker. World Scientific Publishing Company; 2017.*

24CYS103	PRINCIPLES OF ENGINEERING	L-T-P-C: 2-0-3-3

Prerequisites: Nil

Course Objectives

- Understand basic connections between science and engineering.
- To impart basic knowledge of electrical quantities and provide working knowledge for the analysis of DC and AC circuits.
- Understand the characteristics and applications of diode and Transistors.
- To facilitate understanding of Thyristors and operational amplifier circuits.

Course Outcomes

CO1: Ability to understand engineering concepts as well as basic electric and magnetic circuits.

CO2: Ability to analyse DC and AC circuits.

CO3: Ability to understand the basic principles of PN junctions and transistors.

CO4: Ability to analyse basic transistor and op-amp based circuits.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												2	
CO2	3	3	2										2	
CO3	3												2	
CO4	3	2	2										3	

Syllabus

Unit 1

Overview and history of Engineering. Engineering marvels of the ancient world. Connections between Science and Engineering, connection between Maths and Engineering. Roles of different fields of Engineering.
Introduction to Electrical Engineering, current and voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Energy and Power, Super position Theorem, Network Analysis – Mesh and Node methods- Faraday's Laws of Electro-magnetic Induction, Magnetic Circuits, Self and Mutual Inductance, Single Phase, 3 Phase and Network Grids.

Unit 2

PN Junction diodes, Diode Characteristics, Diode approximation- Clippers and Clampers, Rectifiers: Half wave, Full wave, Bridge- Zener Diode- Design of regulator and characteristics, Optoelectronic devices, Introduction to BJT, Characteristics and configurations, Transistor as a Switch.

Unit 3

Field Effect Transistors – Characteristics, Thyristors – operation and characteristics, Diac, Triac –Thyristor based power control, IC 555 based Timer-multi-vibrators, Operational Amplifiers – Inverting and Non-inverting amplifier, Oscillators, Instrumentation amplifiers.

Textbook

Edward Hughes. Electrical and Electronic Technology, 10th Edition, Pearson Education Asia, 2019.

Reference Book(s)

1. *A. P. Malvino, Electronic Principles, 7th Edition, Tata McGraw Hill, 2007.*
2. *Handley, Brett, Craig Coon, and David M. Marshall. Principles of engineering. Cengage Learning, 2012.*
3. *S. K. Bhattcharya, Basic Electrical and Electronics Engineering, Pearson, 2012.*
4. *Vincent Del Toro, Electrical Engineering Fundamentals, Prentice Hall of India Private Limited, 2nd Edition, 2003.*
5. *David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008.*
6. *Michael Tooley B. A., Electronic circuits: Fundamentals and Applications, 3rd Edition, Elsevier Limited, 2006.*

24CYS104	COMPUTER HARDWARE AND SYSTEM ESSENTIALS	L-T-P-C: 2-0-3-3

Prerequisites: Nil

Course Objectives

- Computer hardware essentials is designed to introduce students to a basic understanding of the different types of computing devices, computer components (CPU, memory, power supplies, etc.), and operating systems.
- It also introduces building a fully functional Linux and Installing applications.
- Understand the basic of circuit building.

Course Outcomes

CO1: Understand components of computer system (computer memory and ports)

CO2: Understand the procedure for Installation of OS - Linux and supporting, upgrading and new applications

CO3: Understand the concepts of number system, logic circuits, Boolean algebra and strategies for minimization of logic circuits

CO4: Design combinational circuits – multiplexers, decoders and encoders

CO5: Design sequential circuits – Flip flops, registers, counters, design using FSM

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			1								3	2
CO2	3	2			1								3	2
CO3	2	1											3	2
CO4	1	1			2								3	2
CO5	1	1			1				2	2	1	1	3	2

Syllabus

Unit 1

Components of Computer System: Computer Memory: Secondary storage device types, Basic Principles of operation: Sequential Access device, Direct Access device -Magnetic disks, Optical disks, memory storage devices, Ports: Serial and Parallel Ports. System software: bootstrap module, configuration, OS loading: typical Linux virtual machine. Installing a Linux virtual machine. Understanding disk partitions and obtaining partition

information using system tools. Linux operating system and basic Linux commands. Mobile Architechure : hardware components

Unit 2

Number systems - Signed and Unsigned numbers arithmetic, Binary, Decimal, Octal, Hex, BCD etc. Introduction to logic circuits: Variables and functions, Inversion- Truth tables - Logic Gates and Networks - Boolean algebra - Synthesis using gates - Design examples - Optimized implementation of logic functions: Karnaugh map - Strategy for minimization - Minimization of product of sums forms - Incompletely specified functions - Multiple output circuits - Tabular method for minimization.

Unit 3

Combinational circuit building blocks: Multiplexers - Decoders - Encoders, Sequential circuit building blocks: Flipflops-SR, JK, D and T - Registers – Counters – FSM : A simple sequential circuit design example from state diagram.

Textbook

Brookshear JG. Computer science: an overview. Eleventh Edition, Addison-Wesley Publishing Company; 2011.

Reference(s)

1. *Norton, Peter. Introduction to computers. Sixth edition, Tata McGraw-HILL; 2008.*
2. *Wakerly JF. Digital Design Principles and Practices. Fourth Edition, Pearson Education; 2008.*
3. *Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications; 2010.*
4. *Givone DD. Digital Principles and Design.Tata McGraw Hill Publishing Company Limited; 2003.*
5. *Mano MM, Ciletti MD. Digital Design with Introduction to the Verilog HDL.Fifth Edition, Pearson Education; 2015.*
6. *Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Ninth Edition, Wiley; 2012.*
7. *Cobbaut P. Linux Fundamentals. Samurai Media Limited; 2016.*
8. *Halsey M. Windows 10 Troubleshooting. Apress; 2016.*
9. *Soyinka W. Linux Administration: A Beginner's Guide. Fifth Edition, Mc Graw Hill*
10. *Professional; 2008.*
11. *Englander, Irv. The Architecture of Computer Hardware, System Software, and Networking. An Information Technology Approach, Sixth Edition, John Wiley & Sons; 2021.*

22ADM101	FOUNDATION OF INDIAN HERITAGE	L-T-P-C: 2-0-1-2

Course Objective

- The course is designed as an introductory guide to the variegated dimensions of Indian cultural and intellectual heritage, to enable students to obtain a synoptic view of the grandiose achievements of India in diverse fields.
- It will equip students with concrete knowledge of their country and the mind of its people and instill in them some of the great values of Indian culture.

Course Outcomes

CO1: Be introduced to the cultural ethos of Amrita Vishwa Vidyapeetham, and Amma's life and vision of holistic education.

CO2: Understand the foundational concepts of Indian civilization like puruśārtha-s, law of karma and varṇāśrama.

CO3: Gain a positive appreciation of Indian culture, traditions, customs and practices.

CO4: Imbibe spirit of living in harmony with nature, and principles and practices of Yoga.

CO5: Get guidelines for healthy and happy living from the great spiritual masters.

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1						3	2	3				2		
CO2						3	1	3				2		
CO3						3	1	3				2		
CO4						3	3	3				2		
CO5						3	1	3				2		

Syllabus

Unit 1

Introduction to Indian culture; Understanding the cultural ethos of Amrita Vishwa Vidyapeetham; Amma's life and vision of holistic education.

Unit 2

Goals of Life – Purusharthas; Introduction to Varnasrama Dharma; Law of Karma; Practices for Happiness.

Unit 3

Symbols of Indian Culture; Festivals of India; Living in Harmony with Nature; Relevance of Epics in Modern Era; Lessons from Ramayana; Life and Work of Great Seers of India.

Text Book

Cultural Education Resource Material Semester-1

Reference Book(s)

1. *The Eternal Truth (A compilation of Amma's teachings on Indian Culture)*
2. *Eternal Values for a Changing Society. Swami Ranganathananda. Bharatiya Vidya Bhavan.*
3. *Awaken Children (Dialogues with Mata Amritanandamayi) Volumes 1 to 9*
4. *My India, India Eternal. Swami Vivekananda. Ramakrishna Mission.*

22AVP103	MASTERY OVER MIND	L-T-P-C: 1-0-2-2

Course Objective

- Mastery Over Mind (MaOM) is an Amrita initiative to implement schemes and organize university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3)
- It gives an introduction to immediate and long-term benefits of MA OM meditation and equips every attendee to manage stressful emotions and anxiety, in turn facilitating inner peace and harmony.
- This course will enhance the understanding of experiential learning based on the University's mission: "Education for Life along with Education for Living" and is aimed to allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals.

Course Outcomes

CO1: To be able to describe what meditation is and to understand its health benefits

CO2: To understand the causes of stress and how meditation improves well-being

CO3: To understand the science of meditation

CO4: To learn and practice MAOM meditation in daily life

CO5: To understand the application of meditation to improve communication and relationships

CO6: To be able to understand the power of meditation in compassion- driven action

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	2		2		
CO2			2		2				2	2		2		
CO3					2			2	2	2		2		
CO4			3		3		2	3	3	3		3		
CO5			2		2			2	2	3		3		
CO6			2			2		2	2	3		3		

Syllabus

Unit 1: Describe Meditation and Understand its Benefits (CO1)

A: Importance of meditation. How does meditation help to overcome obstacles in life

Reading 1: Why Meditate? (Swami Shubamritananda ji)

Video Resource: Pre-recorded Video with Swami Shubhamritananda Puri

Unit 2: Causes of Stress and How Meditation Improves Well-being (CO2)

A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation.
B: Causes of Stress. The problem of not being relaxed. Effects of stress on health. How meditation helps to relieve stress. Basics of stress management at home and the workplace.

Reading 1: Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress. Mayo Clinic. https://www.mayoclinic.org/tests-procedures/meditation/in-depth/meditation/art- 20045858 (PDF provided)

Reading 2: 'Efficient Action.' Chapter 28 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust. Video Resource: Pre-recorded Video with Dr. Ram Manohar

Video Resource: Pre-recorded Video with Prof. Udhayakumar

Unit 3: The Science of Meditation (CO3)

A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method?
B: How meditation helps humanity according to what we know from scientific research

Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)

Reading 2: 'Science and Spirituality.' Chapter 85 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Video Resource: Pre-recorded Video with Dr. Shyam Diwakar

Unit 4: Practicing MA OM Meditation in Daily Life (CO4)

Guided Meditation Sessions following scripts provided (Level One to Level Five)

Reading 1: MA OM and White Flower Meditation: A Brief Note (Swami Atmananda Puri)

Reading 2: 'Live in the Present Moment.' Chapter 71 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Video Resource: Pre-recorded Video with Swami Atmananda Puri

Unit 5: Improving Communication and Relationships (CO5)

How meditation and mindfulness influence interpersonal communication. The role of meditation in improving relationship quality in the family, at the university and in the workplace.

Reading 1: Seppala E (2022, June 30th) 5 Unexpected Ways Meditation Improves Relationships a Lot. Psychology Today. https://www.psychologytoday.com/intl/blog/feeling-it/202206/5-unexpected-ways- meditation-improves-relationships-lot

Reading 2: 'Attitude.' Chapter 53 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Video Resource: Pre-recorded Video with Dr. Shobhana Madhavan 3

Unit 6: Meditation and Compassion-driven Action (CO6)

Understand how meditation can help to motivate compassion-driven action. (Pre-recorded video with Dr Shobhana Madhavan)

Reading 1: Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know? Current Opinion in Psychology, 44, 151-156.

Reading 2: 'Sympathy and Compassion.' Chapter 100 in Amritam Gamaya (2022). Mata Amritanandamyi Mission Trust.

Video Resource: Pre-recorded Video with Dr.Shobhana Madhavan

Course Assessment Specification Table

		CO1	CO2	CO3	CO4	CO5	CO6	Total
1	**Group Project** (Example: Role Play)	20						20
2	**Class Participation**				40			40
3	**Individual Reflective Exercise**					10	10	20
4	**End-term Examination**	4	4	4		4	4	20

Text Book/ Reference Book(s)

1. *Chinmayananda, Swami. The Holy Geeta. Central Chinmaya Mission Trust, 1996.*
2. *Devi, Sri Mata Amritanandamayi. Amritam Gamaya Part 1. Translated by Rajani Menon. M A Center, 2022*
3. *Easwaran, Eknath. Conquest of Mind. 3rd ed. Tomales: Nilgiri Press, 2010.*
4. *Goleman, Daniel, and Richard Davidson. The Science of Meditation: How to Change your Brain, Mind and Body. Penguin UK, 2017.*
5. *Puri, Swami Amritaswarupananda. From Amma's Heart. M.A. Center, 2014.*
6. *Sivananda, Swami. Concentration and Meditation. Garhwal, India: Divine Life Society, 2009.*
7. *Thakar, Vimala. Why Meditation. Delhi, India: Motilal Banarsidass, 1996.*
8. *Vivekananda, Swami. Raja Yoga. India: Sanage Publishing House, 2022.*
9. *Yatiswarananda, Swami. Meditation and Spiritual Life. Sri Ramakrishna Ashrama, 1979.*

SEMESTER II

24MAT118	DISCRETE MATHEMATICS	L-T-P-C: 3-1-0-4

Prerequisites: Nil

Course Objectives

- Familiarization of various concepts in logic and proof techniques.
- Understand the concepts of various types of relations, partial ordering and equivalence relations.
- Understand the concepts of generating functions and apply them to solve the recurrence relations.

Course Outcomes

CO1: Apply logical reasoning, counting principles, and proof techniques.

CO2: Analyze and manipulate relations, identifying their properties.

CO3: Solve counting problems using advanced techniques and recurrence relations.

CO4: Analyze graphs, identify special types, and apply graph algorithms.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										2	1
CO2	3	3	2											2
CO3	3	3	2										1	
CO4	3	2	1											2

Syllabus

Unit-1

Logic, Mathematical Reasoning and Counting: Logic, Prepositional Equivalence, Predicate and Quantifiers, Theorem Proving, Functions, Mathematical Induction. Recursive Definitions, Recursive Algorithms, Basics of Counting, Pigeonhole Principle, Permutation and Combinations

Unit-2

Relations and Their Properties: Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions.

Unit-3

Advanced Counting Techniques and Relations: Recurrence Relations, Solving Recurrence Relations, Generating Functions, Solutions of Homogeneous Recurrence Relations, Divide and Conquer Relations, Inclusion-Exclusion.

Unit-4

Graphs: Special types of graphs, connectivity, Euler and Hamiltonian Paths.
Trees: Applications of trees, Tree traversal, Spanning trees.

Textbook

Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw- Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.

Reference(s)

1. *James Strayer, Elementary Number Theory, Waveland Press, 2002.*
2. *R.P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Fifth Edition, 2007.*
3. *Thomas Koshy, Discrete Mathematics with Applications, Academic Press, 2005.Liu, Elements of Discrete Mathematics, Tata McGraw- Hill Publishing Company Limited, 2004.*

24MAT119	NUMBER THEORY AND ALGEBRA	L-T-P-C: 3-0-0-3

Prerequisites: Nil

Course Objectives

- To familiar basic results in number theory and understand it applications in information security.
- Familiar few important concepts in number theory like primitive roots, quadratic residues etc.
- Understand the basic concepts of algebraic structures like groups rings and fields.
- Understand the hard problems in number theory and abstract algebra and its applications.

Course Outcomes

CO1: Understand integers with divisibility properties and realize the group structure in integers using modular operations.

CO2: To Understand concepts of quadratic residues and Primitive roots.

CO3: To understand the basic concepts of algebraic structures like groups, rings and fields

CO4: To Understand the computationally hard problems like factorization and discrete logarithm problems and the techniques to solve these problems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										1	2
CO2	3	3	2										2	3
CO3	3	3	2										1	1
CO4	3	2	1										1	1

Syllabus

Unit 1

Algorithms for integer arithmetic: Divisibility, GCD, modular arithmetic, modular exponentiation, congruence, Chinese remainder theorem, orders and primitive roots, quadratic residues, integer and modular square roots, continued fractions, and rational approximations.

Unit 2

Algebraic Structures - Groups, Rings and Fields; Representation of finite fields: Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, irreducible polynomials.

Unit 3

Root-finding and factorization algorithm. Elliptic curves: The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm. Primality testing algorithms: Fermat Basic Tests, Miller–Rabin Test. Integer factoring algorithms: Trial division, Pollard rho method, Computing discrete logarithms over finite fields: Baby-step-giant-step method, Pollard rho method, Pohlig-Hellman method, index calculus methods, linear sieve method.

Textbook

James Strayer, Elementary Number Theory, Waveland Press, 2002.

Reference(s)

1. *John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson Education Inc. 2003.*
2. *Apostol, Tom M. Introduction to analytic number theory. Springer Science & Business Media, 20131.*
3. *Yan, Song Y. Computational Number Theory and Modern Cryptography. John Wiley & Sons, 2012.*
4. *Joseph A. Gallian, Contemporary Abstract Algebra, Cengage Learning, 2013.*

24CYS111	DIGITAL SIGNAL PROCESSING	L-T-P-C: 2-0-1-3

Pre-Requisite(s): Nil

Course Objectives

- To introduce the frequency domain concepts and filter design in signal processing applications.
- To develop knowledge in efficient transforms for signal analysis.
- To provide knowledge in designing and developing signal processing systems suitable for various applications.

Course Outcomes

CO1: To understand the concepts of signals and systems.

CO2: To analyze the frequency domain characteristics of discrete time signals and systems

CO3: To comprehend realization structures for filters.

CO4: To develop a digital signal processing system for different applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2										2	2	
CO2	3	2	3									2	2	
CO3	3	2		2								2	2	
CO4	3	2	3	2								2	2	2

Syllabus

Unit 1

Basic signals: unit step, unit impulse, sinusoidal and complex exponential signals - Types of signals- Basic operations on signals - system properties -Time Domain characterization of continuous time and discrete time LTI system-Convolution Integral - Convolution sum-Analysis of LTI system described by differential and difference equations.

Unit 2

Discrete Fourier transforms: Fourier Transform, Fourier analysis of discrete time signals and systems: Discrete Time Fourier series – Discrete Time Fourier Transform - properties of DTFT – Introduction to DFT- properties of DFT – linear filtering methods based on DFT – FFT algorithms.

Unit 3

Digital filters: Introduction, specifications of practical filters, Characteristics of commonly used analog filters – IIR filters: design by approximation of derivatives – impulse invariance and bilinear transformation – Butterworth filter- frequency transformations for analog and digital filters, Structures for IIR systems. FIR filters: symmetric and anti-symmetric FIR filters – design of linear phase FIR filter using windows –Structures for FIR systems – direct form structures, Linear phase, and cascade form structures. Brief introduction to Wavelets and Wavelet transforms.

Textbook

Simon Haykin, Barry Van Veen, Signals and Systems, Second Edition, John Wiley and Sons, 2007.

Reference(s)

1. *Alan V. Oppenheim, Alan S. Wilsky, S, Hamid Nawab, Signals and Systems, Prentice Hall India private Limited, Second Edition, 1997.*
2. *John G Proakis, G. Manolakis, Digital Signals Processing Principles, Algorithms, Applications, Prentice Hall India Private Limited, Fourth Edition, 2007.*
3. *Sanjit K. Mitra, Digital Signal Processing: A computer-based approach, Tata McGraw Hill Publishing Company Limited, Fourth Edition,2010.*
4. *Allen V. Oppenheim, Ronald W. Schafer, Discrete time Signal processing, Prentice Hall India Private Limited, Third Edition, 2013.*

24CYS112	COMPUTER ORGANIZATION AND ARCHITECTURE	L-T-P-C: 3-0-3-4

Pre-Requisite(s): Nil

Course Objectives

- This course aims at introducing the concepts of computer architecture and organization.
- It describes overview of MIPS architecture in terms of instruction set, data path and pipelining.
- It introduces pipelining and memory systems in detail along with performance metrics for designing computer systems.

Course Outcomes

CO1: Understand the design principles of Instruction Set Architecture (ISA) by taking MIPS as reference.
CO2: Understand design of instruction execution using Multiple Clock Cycles and Analyze / Evaluate the performance of processors.
CO3: Understand Pipelined architecture and Design of 3 and 5 stage pipeline processor in MIPS
CO4: Understand the working of Arithmetic and Logic Unit and the concepts of Memory Organization.
CO5: Understand the microprocessor design, microcontroller, and addressing modes.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1										3	2
CO2	3	3	3	2	2								3	2
CO3	2	2	2										3	2
CO4	2	2	3	2									3	2
CO5	2	2	2	2	1								3	2

Syllabus

Unit 1

Introduction and Performance of Computing system, Processor Architecture with example as MIPS & Instruction Set, Single Cycle Datapath Design, Control Hardware, Computer Arithmetic, Introduction to multicycle at a path, Pipelining Technique – Design Issues, Hazards: Structural Hazards, Data Hazards and Control Hazards, Static Branch Prediction, Dynamic Branch Prediction, Advanced Concepts in pipelining.

Unit 2

Memory Organization - Introduction, Cache Memory Organization, Main Memory & Interleaving, VRAM, Input-output organization - Accessing I/O devices-program controlled I/O-interrupts – Enabling & Disabling interrupts - handling multiple devices - device identification - vectored interrupts – interrupt nesting – Simultaneous requests.

Unit 3

Introduction to 8-bit microprocessor: Internal architecture of Intel 8085 microprocessor: Block diagram, Registers, Internal Bus Organization, Functional details of pins, Control signals, External Address / Data bus multiplexing, Demultiplexing. 8085 instruction set: Instructions, Classifications, addressing modes, Programming examples, Instruction Timing, I/ O mapped I/ O, and memory mapped I/ O techniques. Interrupts of the 8085 Microprocessor. Introduction to 8086 - 8086 Architecture - Addressing Modes - Instruction Set and Programming, Assembler Directives. 8086 hardware design: minimum mode and maximum mode configurations, Bus structure, bus buffering, latching, system bus timing with diagram, Interrupt of 8086 Microprocessor.

Textbook

Patterson DA, Hennessy JL. Computer Organisation and Design, The Hardware/Software interface (ARM Edition). Fourth Edition, Morgan Kaufmann; 2010.

Reference(s)

1. *Hamacher et.al. Computer Organisation. Sixth Edition, McGraw-Hill; 2017.*
2. *Hennessy JL, Patterson DA. Computer architecture: a quantitative approach. Fifth Edition, Morgan Kauffmann; 2011.*
3. *Hayes JP. Computer Organisation and Architecture. Third Edition, McGraw Hill; 2017.*
4. *Stallings W. Computer Organisation and Architecture.Tenth Edition, PHI; 2016.*
5. *Carl Hamacher, Naraig Manjikian, Safwat G. Zaky, Zvonko G. Vranesic, Computer Organization and Embedded Systems ,6th Edition,McGraw Hill Education (India) Private Limited. ISBN: 9780071089005.*

24CYS113	COMPUTER PROGRAMMING	L-T-P-C: 3-0-0-3

Pre-Requisite(s): 24CYS102 Problem Solving and Algorithmic Thinking

Course Objectives

- This course provides the foundations of programming, using C.
- The basic syntax and semantics of a typical, low-level programming language, and the principles and methods of using it, will form the focus of this course.

Course Outcome

CO1: Understand the typical programming constructs: data (primitive and compound), control, modularity, recursion etc. thereby to understand a given program

CO2: Understand and analyze a given program by tracing, identifying coding errors and debugging them.

CO3: Make use of the programming constructs appropriately and effectively while developing computer programs.

CO4: Develop computer programs that implement suitable algorithms for problem scenarios and applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1							1					1	2
CO2	1	1	1					1						1
CO3	1	2	2					2					1	
CO4	2	3	2					3					1	2

Syllabus

Unit 1

C for problem solving – Introduction, structure of C programs, data types, data input, output statements, operators, selection, control structures and repetition. Review of C language constructs. Functions – inter function communication, standard functions, scope. Recursion – recursive definition, recursive solution, designing recursive functions, limitations of recursion. Arrays – 1D numeric, searching and sorting, 2D numeric arrays.

Unit 2

Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, arrays of pointers, pointer arithmetic. Strings: fixed length and variable length strings, strings and characters, string input, output, array of strings, string manipulation functions, sorting of strings.

Unit 3

Structures: structure vs array comparison, complex structures, structures and functions, Union. Files and streams, file input output, command line arguments.

Textbook

Forouzan BA, Gilberg RF. Computer Science: A structured programming approach using C. Third Edition, Cengage Learning; 2006.

Reference(s)

1. *Byron Gottfried. Programming with C. Fourth Edition, McGrawHill,; 2018.*
2. *Brian W. Kernighan and Dennis M. Ritchie. The C Programming Language. Second Edition, Prentice Hall, 1988.*
3. *Eric S. Roberts. Art and Science of C. Addison Wesley; 1995.*
4. *Jeri Hanly and Elliot Koffman. Problem Solving and Program Design in C. Fifth Edition, Addison Wesley (Pearson); 2007.*

24CYS181	COMPUTER PROGRAMMING LAB	L-T-P-C: 0-0-3-1

Pre-Requisite(s): 24CYS102 Problem Solving and Algorithmic Thinking

Course Objectives

- This course provides the foundations of programming.
- Apart from the usual mechanics of a typical programming language, the principles and methods will form the focus of this course.
- Shift from learn to program programming to learn forms the core of this course.

Course Outcome

CO1: Understand the typical programming constructs: data (primitive and compound), control, modularity, recursion etc. thereby to understand a given program

CO2: Understand and analyze a given program by tracing, identifying coding errors and debugging them.

CO3: Make use of the programming constructs appropriately and effectively while developing computer programs.

CO4: Develop computer programs that implement suitable algorithms for problem scenarios and applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1							1						2
CO2	1	1	1					1						2
CO3	1	2	2					2					1	
CO4	2	3	2					3						2

Syllabus

Unit 1

Working with functions: Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, types of recursions, Arrays as Function Parameters, Structure, Union, Storage Classes, simple programs using functions, sorting algorithms, Sorting in multidimensional arrays. Sorting in strings. Search problem: Linear search and binary search. Recursive and Iterative formulations.

Unit 2

Pointers and Files- Basics of Pointer: declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect. Pointers and strings. String operations in C. Structures in C. Operations on structures. Passing structures as function arguments. type defining structures. Self-referential structures. Dynamic Data Structures.

Unit 3

File Operations: Sequential access and random access to files: File input-output in C. Streams. Input, output and error streams. Opening, closing and reading from files. In built file handling functions (rewind() ,fseek(), ftell(), feof(), fread(), fwrite()), simple programs covering pointers and files. Programming for command line arguments.

Textbook

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson, 2015.

Reference(s)

1. *E. Balaguruswamy, Programming in ANSI C, 8Th Edition, Tata McGraw-Hill Education; 2019*
2. *Byron Gottfried, Schaum's Outline of Programming with C, Fourth Edition, McGraw-Hill Education; 2018*
3. *Anita Goel and Ajay Mittal, Computer fundamentals and Programming in C, Pearson Education India; 2016*
4. *Rajaraman V, PHI, Computer Basics and Programming in C, Prentice-Hall of India Pvt.Ltd; 2008*
5. *Yashavant P, Kanetkar, Let us C, 16TH Edition, BPB Publications; 2017*

24CYS114	CLASSICAL CRYPTOGRAPHY	L-T-P-C: 3-0-0-3

Prerequisite(s): Nil

Course Objectives

- To introduce different classical cryptographic techniques and its theoretical security analysis.
- To provide and demonstrate different cryptanalysis attacks against the cryptographic techniques, and their attack models.
- To show the impact of these ciphers on society during the time of their use.

Course Outcomes

CO1: Identify the basic language & terminologies of cryptography.

CO2: Demonstrate Encryption and Decryption methods using various classical ciphers.

CO3: Perform cryptanalysis of classical cryptography.

CO4: Understand the concepts of symmetric cryptosystem.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2											3	1
CO2	3	2	3	2	2	1							2	2
CO3	2	2	2	3	3	1							2	2

Syllabus

Transposition Ciphers, Columnar Transposition, Keyword Columnar Transposition, Double Transposition Ciphers, Substitution Ciphers, Poly-alphabetic Ciphers, Affine Ciphers, Simple Substitution Cryptanalysis, Vigenère Cipher, Hill Cipher, One Time Pad, Chinese Remainder Theorem, Fast Modular Exponentiation, LFSR based shift registers, Berlekamp-Massey Algorithm, Block ciphers: Pseudorandom functions and permutations, DES, AES, modes of operation.

Textbook(s)

Mark Stamp and Richard M. Low: Applied cryptanalysis: Breaking Ciphers in the Real World, Wiley-Interscience, 2007.

Reference(s)

1. *Stinson, Douglas Robert, and Maura Paterson, Cryptography: Theory and Practice, CRC press, Fourth Edition, 2019.*

22ADM111	GLIMPSES OF GLORIOUS INDIA	L-T-P-C: 2-0-1-2

Course Objective

- To deepen students' understanding and further their knowledge about the different aspects of Indian culture and heritage.
- To instil into students a dynamic awareness and understanding of their country's achievements and civilizing influences in various fields and at various epochs.

Course Outcome

CO1: Get an overview of Indian contribution to the world in the field of science and literature.

CO2: Understand the foundational concepts of ancient Indian education system.

CO3: Learn the important concepts of Vedas and Yoga sutras and their relevance to daily life.

CO4: Familiarize themselves with the inspirational characters and anecdotes from the Mahabharata and Bhagavad-Gita and Indian history.

CO5: Gain an understanding of Amma's role in the empowerment of women

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3					2		
CO2						1		3				2		
CO3						3	3	3				2		
CO4						3	3	3				2		
CO5						1		1						

Syllabus

Unit 1

To the World from India; Education System in India; Insights from Mahabharata; Human Personality. India's Scientific System for Personality Refinement.

Unit 2

The Vedas: An Overview; One God, Many Forms; Bhagavad Gita – The Handbook for Human Life; Examples of Karma Yoga in Modern India.

Unit 3

Chanakya's Guidelines for Successful Life; Role of Women; Conservations with Amma.

Textbook

Cultural Education Resource Material Semester-2

Reference Book(s)

1. *Cultural Heritage of India. R.C.Majumdar. Ramakrishna Mission Institute of Culture.*
2. *The Vedas. Swami Chandrashekhara Bharati. Bharatiya Vidya Bhavan.*
3. *Indian Culture and India's Future. Michel Danino. DK Publications.*
4. *The Beautiful Tree. Dharmapal. DK Publications.*
5. *India's Rebirth. Sri Aurobindo. Auroville Publications.*

SEMESTER III

24CYS201	OPTIMIZATION TECHNIQUES	L-T-P-C: 3-1-0-4

Pre-Requisite(s): Nil

Course Objectives

- To build an understanding of basics of optimization techniques
- To introduce basics of linear programming and meta-heuristic search techniques
- To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems

Course Outcomes

CO1: Formulate mathematical models for optimization problems

CO2: Analyze the complexity of solutions to an optimization problem

CO3: Develop hybrid models to solve an optimization problem

CO4: Apply Evolutionary Computation Methods to find solutions to complex problems

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1										
CO2	3	3	2	1										
CO3	3	3	3	2										
CO4	3	3	3	2										

Syllabus

Unit 1

Introduction to optimization: optimal problem formulation, engineering optimization problems, optimization algorithms, numerical search for optimal solution.
Calculus: Single variable nonlinear optimization - Optimality criteria, maxima, minima and inflection point with problems, Multivariable nonlinear optimization- Optimality criteria, Hessian matrix, convexity and concavity of a function, global minima and maxima, local minima and maxima, and saddle point with problems.

Unit 2

Geometry of LPP, Simplex algorithm, two phases of Simplex method, Revised Simplex method, Duality in LPP, Dual simplex method

Unit 3

Region elimination methods: Interval halving method, Fibonacci search method, golden section search method.
Point estimation method: successive quadratic search method.
Derivative based methods: Bisection method, Secant method, Newton's method.

Unit 4

Gradient based methods: Steepest descent method, Newton's method, Levenberg-Marquardt Method and Powell method.

Unit 5

Nature inspired optimization techniques: Genetic Algorithm (GA) (Genetic Operations on Binary Strings, Analysis of GA), Introduction to Particle Swarm Optimization and ant colony Optimisation.

Textbooks

Singiresu S. Rao. Engineering Optimization: Theory and Practice. Fifth edition. Wiley; 2019.

Reference Books

1. *R.L. Burden, J. D. Faires, Numerical Analysis, 9th edition, Richard Stratton, 2011.*
2. *S.Haykin, Neural Networks: A Comprehensive Foundation. Upper Saddle River, NJ: Prentice Hall Inc, 1999.*
3. *D. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning. Reading, MA: Addison-Wesley, 1989.*
4. *S. Nayak, Fundamentals of Optimization Techniques with Algorithms, 1st edition, Academic Publisher, 2020.*
5. *Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, Prentice Hall, 2002.*
6. *J. Zurada, Introduction to Artificial Neural Systems. St. Paul, MN: West Publishing Co., 1992.*
7. *D. Fogel, Evolutionary Computation. New York: IEEE Press, 1995.*

24CYS202	USER INTERFACE DESIGN	L-T-P-C: 1-0-3-2

Pre-Requisite(s): Nil

Course Objectives

- To impart the design, development and implementation of Dynamic Web Pages.
- To develop programs for Web using JavaScript
- To give an introduction to responsive web design
- To deploy web applications

Course Outcome

CO1: Understand the basics of World Wide Web and UI Design Principles.

CO2: Develop interactive Web pages using HTML

CO3: Build a professional document using Cascaded Style Sheets.

CO4: Construct websites for user interactions using JavaScript.

CO5: Develop and deploy web applications using Node.js

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												3	3
CO2	1	2						1	3				2	2
CO3	1	2						2	3	2			2	2
CO4	1	2						2	3				2	2
CO5	3	2	2					2	3	2	3		2	2

Syllabus

Unit 1

Introduction to World Wide Web – Client-Server Architecture – Web Server – Application Server; User Interface Design Principles: Shneiderman's Golden Rules; Introduction to HTML – HTML Basics – Elements and Tags – Adding Web Links and Images – Creating Tables – Forms – Create a Simple Web Page – HTML5 Elements – Media – Graphics.

Unit 2

CSS Basics – Features of CSS – Implementation of Borders – Backgrounds – CSS3 – Text Effects – Fonts – Page Layouts with CSS; Responsive Web Design – Grid view – Media Queries – Images – Videos –Frameworks and Templates.

Unit 3

Introduction to JavaScript – Form Validations – Event Handling – Document Object Model (DOM); Introduction to Server Side Scripting – Node.js – Modules - NPM - Events; Deploying an application – Hosting Basics – Deployment Techniques.

Text Book(s)

1. *DT Editorial Services. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery). Second Edition, Dreamtech Press; 2016.*
2. *Ben Frain. Responsive Web Design with HTML5 and CSS. Third Edition. Packt Publishing;2020.*

Reference(s)

1. *Ethan Marcotte, Responsive Web Design, Second Edition; 2014*
2. *Tittel E, Minnick C. Beginning HTML5 and CSS3 for Dummies. Third edition, John Wiley & Sons; 2013.*
3. *Powell TA, Schneider F. JavaScript: the complete reference. Paperback edition, Tata McGraw-Hill; 2012.*

24CYS203	OPERATING SYSTEMS	L-T-P-C: 3-0-0-3

Pre-Requisite(s): 24CYS104 - Computer Hardware and System Essentials

Course Objectives

- To introduce the structure and implementation of modern operating systems, virtual machines and their applications.
- To summarize techniques for achieving process synchronization and managing resources like memory, CPU, and files and directories in an operation system.
- To study common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems (such a priority, performance comparison, and fair-share schemes) will be done.
- To give a broad overview of memory hierarchy and the schemes used by the operating systems to manage storage requirements efficiently.

Course Outcomes

CO1: Understand the architecture and functionalities of modern OS.

CO2: Understand and apply the algorithms for resource management and scheduling.

CO3: Analyze and apply semaphores and monitors for classical and real-world synchronization scenarios.

CO4: Engage in independent learning as a team to study characteristic features of modern operating systems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												3	1
CO2	2												3	2
CO3	2	2											2	2
CO4	3				2			2	3	2	2	2	2	3

Syllabus

Unit 1

Operating systems Services: Overview – hardware protection – operating systems services – system calls – system structure – virtual machines. Process and Processor management: Process concepts – process scheduling – operations on process – cooperating process – inter-process communication – multi threading models – threading issues – thread types – CPU scheduling – scheduling algorithms.

Unit 2

Process synchronization: critical section problem – synchronization hardware – semaphores – classical problems of synchronization – critical regions – monitors – deadlocks – deadlock characterization – methods of handling deadlocks – deadlock prevention – avoidance – detection and recovery. Memory management – swapping – contiguous memory allocation. Paging and segmentation – segmentation with paging – virtual memory – demand paging – process creation – page replacement – thrashing.

Unit 3

File management: File systems: directory structure – directory implementation – disk scheduling. Case study: threading concepts in operating systems, kernel structures.

Textbook(s)

Silberschatz A, Gagne G, Galvin PB. Operating System Concepts. Tenth Edition, Wiley; 2018.

Reference Book(s)

1. *Deitel HM, Deitel PJ, Choffnes DR. Operating systems. Third Edition, Prentice Hall; 2004.*
2. *Tannenbaum AS. Modern Operating Systems. Fourth Edition, Prentice Hall; 2016.*
3. *Stevens WR, Rago SA. Advanced programming in the UNIX environment. Second Edition, Addison-Wesley; 2008.*
4. *Nutt G. Operating systems. Third Edition, Addison Wesley; 2009.*

24CYS281	OPERATING SYSTEMS LAB	L-T-P-C: 0-0-3-1

Pre-Requisite(s): 24CYS203 Operating Systems, 24CYS104 Computer Hardware and System Essentials

Course Objectives

- This course aims to provide the students an in-depth understanding of process management, inter process communication and implementation of various CPU scheduling algorithms.
- To impart an in-depth knowledge on semaphores, threads, deadlock, paging and page replacement techniques.
- To implement various file Organization methods and file allocation strategies.

Course Outcomes

CO1: Experiment with Linux commands

CO2: Implement program for file and process management using system calls

CO3: Choose the best CPU scheduling algorithm for a given problem instance

CO4: Identify the performance of various page replacement algorithms

CO5: Develop algorithm for deadlock avoidance, detection and file allocation strategies

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	3				1	1	1		2	2
CO2	2	2	2	1	3				1	2	1		3	3
CO3	2	2	2	1	3				1	2	1		2	3
CO4	1	2	1	2	3				2	1	1		3	2
CO5	2	2	2	2	3				1	1	1		3	3

Syllabus

Unit 1

Basics of Linux Commands: Simulation of linux commands like cp, ls, grep - Exploring System calls: fork, exec, getpid, exit, wait, close, stat, opendir, readdir etc. - Shell Programming: I/O, Decision making, Looping, Multi-level branching – Virtualization: Implementation of OS / Server Virtualization - Threads: Building multi-threaded and multi-process applications - CPU Scheduling algorithms: Implementation of Round Robin, Shortest Job First, first come first served.

Unit 2

Semaphores: Implementation of Semaphores – Implementation of Shared memory, IPC. Deadlock: Bankers Algorithm for Deadlock Avoidance, Implementation of Deadlock Detection Algorithm. CPU Synchronization: Implementation of threading and synchronization applications. Memory Allocation Methods for fixed partition: First Fit, Worst Fit, Best Fit. Paging: Implementation of Paging Technique, Page Replacement Algorithms: First in First Out (FIFO), Least recently used (LRU), least frequently used (LFU).

Unit 3

File Organization: Implementation of the various File Organization Techniques (Single level directory, two level, Hierarchical, DAG) - File Allocation Strategies: Sequential, Indexed, Linked.

Textbook(s)

Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Tenth Edition, John Wiley and Sons; 2018.

Reference Book(s)

1. *Garry. J. Nutt, Operating Systems: A Modern Perspective, Third Edition, Addison-Wesley; 2012*
2. *Andrew S. Tanenbaum and Herbert Bros, Modern Operating Systems, Fourth Edition, Pearson; 2015*
3. *Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system; 2020*
4. *Sumitabha Das, UNIX Concepts and Applications, Fourth Edition, Tata McGraw-Hill Education; 2017*

24CYS204	ADVANCED PROGRAMMING	L-T-P-C: 3-0-3-4

Pre-Requisite(s): 24CYS113 Computer Programming

Course Objectives

- Primary objective of this course is to introduce advanced programming concepts such as Object-oriented paradigm, advanced pointers and so forth.
- This course focuses on learning Python and C++ with an emphasize on ADT and STL usage for implementing data structures.

Course Outcomes

CO1: Understand the object-oriented programming concepts in statically typed languages and thereby understand a given program.

CO2: Implement ADT in static object-oriented paradigm.

CO3: Analyze the similarities, differences and code efficiency among object-oriented programming languages.

CO4: Develop computer programs that implement suitable algorithms for given problem scenarios and applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				3								3	2
CO2	2	3	2		3			2					3	2
CO3	1	2	2		3			2					3	2
CO4	2	3	2		3			3					3	2

Syllabus

Unit 1

Overview of Object-Oriented Paradigm, Objects as a group of variables, Classes as a named group of methods and data, morphing from structures to classes, Input and Output, Access Specifiers, Member functions: Accessor, Mutator and Auxiliary, Constructors and Destructors, New and Delete Operators, Overloading, Inheritance: Handling Access and Specialization through Overriding, Polymorphism: Virtual Functions, Abstract Class and Virtual Function Tables. Interfaces: Define, Implement, Typing, Extending/Evolving Interface, Annotations, overriding and hiding methods: static, interface and instance methods. Object Class, Final Class and Methods, Packages.

Unit 2

Revisiting Pointers: Pointers to Pointers, Pointers and String Array, Void Pointers and Function Pointers, Standard Template Library, Implementation of Stack, Queue, Hash Table and Linked Lists with STL. Control Statements and Loops, Iterators and Iterable, Functions, Recursion and Parameter Passing, Namespaces and Variable Scope, Exception Handling.

Unit 3

Revisiting Object-Oriented Concepts in Java; Wrapper classes, String, and StringBuilder classes, Number, Math, Random, Array methods, Date-Time. Java files and I/O, Exceptions, Inner classes. Collection framework- Comparator and Comparable, Vector and Array list, Iterator and Iterable, Collection Interfaces: Collection, Set, List, Queue, Dequeue, Map, Object ordering, Sorted Set, Sorted Map, Generics, Serialization. Concurrency Creating Threads, Thread states, Runnable threads, Coordinating Threads, Interrupting Threads, Multi-threading, Runnable Interface.

Text Book(s)

Stroustrup B. Programming: principles and practice using C++. Second edition, Addison Wesley; 2014.

Java 2: The complete reference. Eighth Edition, Tata McGraw- Hill; 2011.

Reference(s)

1. *Deitel PJ. Java how to program. Eleventh Edition, Pearson; 2018. Naughton P. and Schildt H.*
2. *Campione and Walrath, The Java Tutorial, Addison Wesely; 1996.*
3. *Barry Burd, Beginning Programming with Java for Dummies, 5th Edition; 2017*

24CYS205	DATABASE MANAGEMENT SYSTEMS	L-T-P-C: 2-0-3-3

Pre-Requisite(s): Nil

Course Objective

- To understand the concepts of database design, database languages.
- To understand database-system implementation and maintenance.
- To expose to some of the recent trends in databases.

Course Outcomes

CO1: Formulate and apply relational algebraic expressions, SQL and PL/SQL statements to query relational databases.

CO2: Design and build ER models for real world databases.

CO3: Design and build a normalized database management system for real world databases.

CO4: To learn different high-level databases and selection of right database.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3								3	2
CO2	1	3	3	3	3								3	2
CO3	2	3	2	3	3			2			2	2	3	2
CO4	1	1		2	2								3	2
CO5	1	1											1	2

Syllabus

Unit 1

Introduction: Overview of DBMS fundamentals – Overview of Relational Databases and Keys. Relational Data Model: Structure of relational databases – Database schema – Formal Relational Query Languages – Overview of Relational Algebra and Relational Operations. Database Design: Overview of the design process - The E-R Models – Constraints - Removing Redundant Attributes in Entity Sets - E-R Diagrams - Reduction to Relational Schemas - Entity Relationship Design Issues - Extended E-R Features – Alternative E-R Notations – Overview of Unified Modelling Language (UML).

Unit 2

Relational Database Design: Features of Good Relational Designs - Atomic Domains and 1NF - Decomposition using Functional Dependencies: 2NF, 3NF, BCNF and Higher Normal Forms. Functional Dependency Theory - Algorithm for Decomposition – Decomposition using multi-valued dependency: 4NF and 4NF decomposition. Database design process and its issues. SQL: review of SQL – Intermediate SQL.

Unit 3

Advanced SQL. Case Study: Different types of high-level databases – MongoDB, Hadoop/Hbase. Tips for choosing the right database for the given problem.

Text Book(s)

Silberschatz A, Korth HF, Sudharshan S. Database System Concepts. Sixth Edition, McGraw Hill; 2013.

Reference(s)

1. *Garcia-Molina H, Ullman JD, Widom J. Database System; The complete book. Second Edition, Pearson Education India, 2011.*
2. *Elmasri R, Navathe SB. Fundamentals of Database Systems. Fifth Edition, Addison Wesley; 2006.*
3. *Ramakrishnan R, Gehrke J. Database Management Systems. Third Edition, TMH; 2003.*

24CYS206	MODERN CRYPTOGRAPHY	L-T-P-C: 3-0-0-3

Pre-Requisite(s): 24CYS114 Classical Cryptography

Course Objective

- To introduce the basic terminology, concepts, and standards of cryptography.
- Familiarize students with the main approaches, algorithms, and protocols in modern cryptography.
- To explain the principles and underlying mathematical theory of today's cryptographic algorithms.
- To provide an understanding of potential weaknesses and problems with ciphers

Course Outcomes

CO1: Understand the concepts of symmetric cryptosystem.

CO2: Understand different techniques for message integrity.

CO3: Understand the concepts of public key cryptosystem.

CO4: Understand the concept of digital signatures.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												3	3
CO2	2	2	2					1					3	3
CO3	2	1											3	3
CO4	2	1						2					3	3

Syllabus

Stream ciphers: Pseudo-random generators, Attacks on the one-time pad, Linear generators, Cryptanalysis of linear congruential generators, Message integrity: Cryptographic hash functions, message authentication code, CBC MAC and its security, Cryptographic hash functions-based MACs, SHA512, SHA3. Public key encryption: RSA, Rabin, Knapsack cryptosystems, Diffie-Hellman key exchange protocol, ElGamal encryption, Elliptic curve cryptography. Digital signatures: Generic signature schemes, RSA, ElGamal, ECDSA

Textbooks:

Douglas Robert Stinson, Maura Paterson. Cryptography: Theory and Practice (Textbooks in Mathematics). Fourth Edition. Chapman and Hall/CRC;2018.

Reference Books:

1. *William Stallings, Cryptography and Network Security Principles and Practices, Seventh edition, Pearson; 2017*

2. *Wade Trappe, Lawrence C Washington, Introduction to Cryptography with coding theory, Pearson; 2006*
3. *W. Mao, Modern Cryptography – Theory and Practice, Pearson Education; 2004*
4. *Charles P. Pfleeger, Shari Lawrence Pfleeger, Security in computing, Fifth Edition, Prentice Hall of India; 2015*

23LSE201	Life Skills for Engineers I	L-T-P-C: 1-0-2-P/F

Pre-requisite: An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Support them in developing their problem solving and reasoning skills
- Facilitate the enhancement of their communication skills

Course Outcomes

CO1 - Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.
CO2 - Soft Skills: To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
CO3 - Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.
CO4 - Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To infer the meaning of words and use them in the right context. To have a better understanding of the basics of English grammar and apply them effectively.
CO6 - Verbal: To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3	3		3
CO2									2	3		3
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Soft Skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback, Need for change in mindset and up-skilling to keep oneself competent in the professional world.
Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

Aptitude

Problem Solving I
Numbers: Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices, Square roots, Cube Roots and Simplification.
Percentage: Basics, Profit, Loss & Discount, and Simple & Compound Interest.

Ratio, Proportion & Variation: Basics, Alligations, Mixtures, and Partnership.
Averages: Basics, and Weighted Average.
Data Interpretation: Tables, Bar Diagrams, Venn Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, Network Diagrams and other forms of data representation.

Verbal

Vocabulary: Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.
Grammar (**Basic**): Help students learn the usage of structural words and facilitate students to identify errors and correct them.
Reasoning: Stress the importance of understanding the relationship between words through analogy questions.
Speaking Skills: Make students conscious of the relevance of effective communication in today's world through various individual speaking activities.

References:

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), "Effective Team Building: How to make * winning team", London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan's – GRE Comprehensive Programme
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50
Pass / Fail		

*CA - Can be **presentations, speaking activities and tests.**

AMRITA VALUE PROGRAMMES

22AVP201 Message from Amma's Life for the Modern World

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

22ADM211 Leadership from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

22ADM201 Strategic Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

22AVP204 Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

22AVP205 Message of the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

22AVP206 Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

22AVP207 Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, AdiShankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri RamanaMaharshi, Mata Amritanandamayi Devi.

22AVP208 Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

22AVP209 Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

22AVP210 Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an

abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

22AVP213 Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Únity in Diversity" and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

22AVP214 Principles of Worship in India

Indian mode of worship is unique among the world civilizations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realization of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

22AVP215 Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

22AVP218 Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

22AVP219 Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

22AVP220 Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

22AVP221 Indian Martial Arts and Self Defence

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

SEMESTER IV

24CYS211	PROBABILITY AND STATISTICS	L-T-P-C:3-1-0-4

Pre-Requisite(s): Nil

Course Objectives

- To introduce the modern theory of probability, statistics and its applications to modeling and analysis of stochastic systems.
- To understand the important models of discrete and continuous probability distributions and widely used models of sampling distributions.
- To know important applications of probability and statistics in engineering as indispensable tools in decision analysis**.**

Course Outcome

CO1: Understand the concept of probability and its features.

CO2:. Identify the characteristics of different discrete and continuous probability distributions**.**

CO3: Identify the type of statistical situation to which different distributions can be applied

CO4: Apply and calculate expected value and moments

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		1									3	3
CO2	3	1		2									3	3
CO3	3			1									2	2
CO4	3			1									3	3

Syllabus

Unit 1

Sample Space and Events, Interpretations and Axioms of Probability, Addition rules, Conditional Probability, Multiplication and Total Probability rules, Independence, Bayes theorem.

Unit 2

Random variables, Probability Distributions and Probability mass functions, Cumulative Distribution functions, mathematical expectation, variance, moments, and moment generating function.

Unit 3

Standard discrete distributions - Binomial, Poisson, Uniform, Geometric distributions, Negative binomial and Hypergeometric Distributions -Standard continuous distributions - Uniform, Exponential, Gamma, Beta and Normal distributions. Chebyshev's theorem.

Unit 4

Two dimensional random variables-Joint, marginal and conditional probability distributions for discrete and continuous cases, independence, expectation of two-dimensional random variables - conditional mean, conditional variance, covariance and correlation.

Unit 5

Theory of estimation, Point Estimation, Minimum Variance Unbiased Estimate, Standard Error, Maximum Likelihood Estimation method, Bayesian Estimation of Parameters, Statistical Interval for Mean and Variance, Test of Hypothesis for Single Sample – Mean, Variance. Statistical Inference of Two Samples, Inference for the Difference of Two Means, Inference on two variances. Sampling Distributions

Textbooks:

Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers. Seventh Edition. Wiley;2018.

Reference Books:

1. *Ross S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier Academic Press; 2004*
2. *Kreyszig, Erwin. Advanced Engineering Mathematics, Tenth Edition, Wiley; 2010*
3. *Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, Eighth Edition, Pearson Education Asia; 2007.*
4. *Amir D Azcel, Jayavel Sounderpandian, Palanisamy Saravanan and Rohit Joshi, Complete Business Statistics, Seventh Edition McGraw Hill education; 2012*
5. *Ravichandran, J. Probability and Statistics for engineers, First Reprint Edition, Wiley India, 2012.*

24CYS212	MULTIMEDIA PROCESSING	L-T-P-C:2-0-3-3

Pre-Requisite(s): 24CYS111 Digital Signal Processing, 24MAT109 Linear Algebra

Course Objectives

- To study the image fundamentals and mathematical transforms necessary for image transform.
- To study image processing techniques like image enhancement, image reconstruction, image compression, image segmentation and image representation.

Course Outcomes

CO1: Understand fundamental principles of image processing and perform basic operations on pixels.

CO2: Apply the image processing algorithms and filters in spatial domain for image enhancement and restoration.

CO3: Analyze images in the frequency domain and explore the frequency domain filters for image enhancement and restoration.

CO4: Apply segmentation algorithms on Images and analyze their performance.

CO5: Apply morphological processing on images for simple image processing applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				2								1	1
CO2	2			1	3				2	2	2		2	2
CO3	2	2			3				2	2	2		3	2
CO4	2			2	3				2	2	2		2	3
CO5	2				3				2	2	2		2	2

Syllabus

Unit 1

Digital Image Fundamentals: Elements of Visual Perception- Image Sensing and Acquisition-Image Sampling and Quantization – Basic Relationships between Pixels - Image interpolation. Multimedia Data - Discrete and Continuous Media, Analog and Digital Signals: Analog/Digital Converter, Text and Static Data, Audio-digitizing Sound, noise cancelation, Graphics, Video, Digital Sampling: Nyquist’s theorem. Intensity Transformations - spatial filtering-smoothing and sharpening spatial filters.

Unit 2

Filtering in frequency domain- Fourier transform of two variables, smoothing and sharpening using frequency domain. Restoration: Noise Models – Restoration using Spatial Filters. Morphological Image Processing: Erosion – Dilation, Erosion, Opening, Closing on Binary Images. Image Segmentation: Fundamentals – Point, Line and Edge Detection – Thresholding - Region Based Segmentation – Region Growing.

Unit 3

Basic Image compression methods: Simple coding schemes, Frequency based coding - Huffman coding, Relative encoding, Run length encoding, LZW compression - Image and video compression standards - MJPEG, MPEG2, MPEG4, H.264, H.26. Color image processing.

Textbook(s)

Gonzalez RC, Woods RE. Digital Image Processing. Third edition. Pearson Education India ;2016.

Reference(s)

1. *Castleman K R. Digital Image Processing, Prentice Hall;1996.*
2. *Li, Ze-Nian, Mark S. Drew, and Jiangchuan Liu. Fundamentals of multimedia. Upper Saddle River (NJ) Pearson Prentice Hall, 2004.*
3. *Russ JC, Russ JC. Introduction to Image Processing and Analysis.CRC press; 2007*
4. *Joan, L. M., J. L. Didier, and F. Chad. MPEG video compression standard, Digital multimedia standards series.1996.*

24CYS213	SYSTEM SECURITY	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS203 Operating System and 24CYS205 Database Management System

Course Objectives

- Capable of analysing, evaluating and enhancing the security of information systems by identifying potential threats and possible countermeasures in the field of database and system security.

Course Outcome

CO1: A quick refresher to the fundamentals of Database and Operating Systems

CO2: Exploring access control security models and policies in database and operating systems

CO3: Familiarize the Challenges, Attacks and Defences in Database Systems

CO4: Exploring the basic functionalities of different types of Malwares

CO5: Familiarize the Challenges, Attacks and Defences in Operating Systems

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3	1		2						3	1
CO2				3	1		2						3	1
CO3				3	1		2						3	1
CO4				3	1		2						3	1
CO5				3	1		2						3	1

Syllabus:

Program vs processes, Transaction recovery and concurrency control in database systems- Schedule, Concurrency control protocols, Deadlock handling. Access control mechanisms in general computing systems - Lampson's access control matrix. Mandatory access control, Authentication mechanisms in databases, DAC, MAC, RBAC, SELinux. Auditing in databases, Statistical inferencing in databases, Private information retrieval viewed as a database access problem. Privacy in data publishing, Virtual Private Databases, Hadoop security. Security and protection in operating systems - access control, auditing, trusted computing base with reference to Multics and the commercial Operating Systems Malware analysis and protection- viruses, worms and Trojans, Rootkits, Ransomware, Polymorphic malware, Malware capture and analysis using honeypots. Common vulnerabilities and Exposures, Secure system configuration, Minimal footprint, Security of booting, Trusted computing, Virtualization techniques for security, Mobile Operating Systems security especially in Android.

Textbooks:

1. *Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in computing, Prentice Hall Professional Technical Reference, Fourth Edition; 2006.*
2. *Michael Palmer, Guide to Operating System Security, Cengage Learning; Second Edition; 2019*

References

1. *M. Gertz and S. Jajodia, Handbook of Database Security-Applications and Trends, Springer; 2008.*
2. *T. Jaeger, Operating System Security, Vol. 1 of Synthesis Lectures on Information Security, Privacy and Trust, Morgan & Claypool Publishers; 2008.*
3. *W. Mauerer, Professional Linux Kernel Architecture, John Wiley and Sons, New York; 2008.*
4. *R Anderson, Security engineering, John Wiley & Sons; 2008.*
5. *Matt Bishop, Computer security: Art and Science, Vol. 2, Addison-Wesley; 2012.*
6. *E. Nikolay, Android Security Internals: An In-Depth Guide to Android's Security Architecture, No Starch Press; 2014.*

24CYS282	SYSTEM SECURITY LAB	L-T-P-C:0-0-3-1

Pre-Requisite(s): 24CYS203 Operating System and 24CYS205 Database Management System

Course Objectives

- To experiment with various security vulnerabilities, attacks and countermeasures in OS and Databases

Course Outcome:

CO1: Experimenting with fundamentals of Database and Operating Systems

CO2: Experimenting with access control models in Database and Operating Systems

CO3: Exploring Challenges, Attacks and Defences in Database Systems with demonstration

CO4: Exploring the basic functionalities of different types of Malwares

CO5: Exploring Challenges, Attacks and Defences in Operating Systems with demonstration

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1	3		1						1	3
CO2				1	3		1						1	3
CO3				1	3		1						1	3
CO4				1	3		1						1	3
CO5				1	3		1						1	3

Syllabus

List of Experiments

1. Exploring the concepts of binaries, libraries (static and dynamic) and Makefile
2. Implementing the discretionary access control mechanism in operating Systems (linux)
3. Implementing the discretionary access control mechanism in databases (mysql)
4. Linux Virtualization (Chroot)
5. Implementing the mandatory access control mechanism (SElinux or AppArmor)
6. Virtual private databases (Oracle label Security)
7. Exploring different types of Malwares and analysis (Static, Dynamic tools and Cuckoo sandbox)
8. Exploring the Honeypot IDS(KFSensor)
9. Exploring the file system of Android Mobile operating system and Malware Analysis (MobSF)

Textbook

1. *Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in computing, Prentice Hall Professional Technical Reference, 4th Edition, 2006*

2. *Michael Palmer, Guide to Operating System Security, Cengage Learning; 2nd edition (January 1, 2019)*

Reference:

1. *Oracle Label Security, https://www.oracle.com/in/database/technologies/security/label-security.html*
2. *Cuckoo Sandbox, https://cuckoosandbox.org/*
3. *KFSensor, http://www.keyfocus.net/kfsensor/*
4. *MobSF, https://www.cyberpunk.rs/mobile-security-framework-mobsf*

24CYS214	MACHINE LEARNING IN CYBER SECURITY	L-T-P-C:2-0-3-3

Pre-Requisite(s): 24MAT109 Linear Algebra, 24CYS211 Probability and Statistics

Course Objectives

- The aim of this course is to provide foundational knowledge in machine learning.
- The students will learn to implement, train and validate the machine learning models and understand the recent algorithms in machine learning through case studies.

Course Outcomes

CO1: Understand issues and challenges of machine learning: data, model selection, model complexity.

CO2: Design and implement various machine learning algorithms in a range of real-world applications.

CO3: Understand strengths and weaknesses of many popular machine learning approaches.

CO4: Analyse the underlying mathematical relationships within and across Machine Learning algorithms.

CO5: Apply the paradigms of supervised and un-supervised learning on use cases of security.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			2								2	2
CO2	2	2		2	3	3	3	2	2	2			2	2
CO3	2	2			3				2	2			3	2
CO4	2	2			3				2	2			2	3
CO5	2	2			3				2	2			2	2

Syllabus

Unit 1

Foundations of supervised learning - Decision trees and inductive bias, Regression Vs Classification, Supervised: Linear Regression, Logistic Regression, Generalisation, Training, Validation and Testing, Problem of Overfitting, Bias vs Variance, Performance metrics, Decision Tree, Random Forest, Perceptron, Beyond binary classification. Case study: Anomaly detection

Unit 2

Advanced supervised learning - Naive Bayes, Bayesian Belief Network, K-Nearest Neighbour, Support vector machines, Markov model, Hidden Markov Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximisation, Neural Networks.

Unit 3

Unsupervised Learning: Curse of Dimensionality, Dimensionality Reduction Techniques, Principal component analysis, Linear Discriminant Analysis Clustering: K-means, Hierarchical, Spectral, subspace clustering, association rule mining. Case Study: Spam filtering /machine learning for end point protection/network protection/ Application security

Text Book(s)

1. *Tom Mitchell. Machine Learning. First Edition McGraw Hill Education; 2017.*

Reference(s)

1. *Christopher M Bishop. Pattern Recognition and Machine Learning. Springer 2010*
2. *Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. Wiley, Second Edition;2007*
3. *Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge, Massachusetts, 2012.*

24CYS215	DATA STRUCTURES AND ALGORITHMS	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS113 Computer Programming

Course Objectives

- This course aims to provide the students with an in-depth understanding of structure and implementation of the common data structures used in computer science.
- It imparts the ability to solve problems by choosing and applying the right data structures.
- It also imparts the ability to improve the efficiency of programs by applying the right data structures.

Course Outcomes

CO1: Understand the linear data structures – Stacks, Queue and Linked List and their functionalities.

CO2: Understand the non-linear data structures – Trees and Graphs and their functionalities.

CO3: To impart familiarity with various sorting, searching and hashing techniques.

CO4: Develop skills to identify and apply appropriate data structures to solve problems and improve their efficiency.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1		3			3					3	
CO2	3	3	3	2										3
CO3	1	3	1	1									2	3
CO4	2	2	2	2	3			3					2	2

Syllabus

Unit 1

Introduction to Data Structures - Abstract Data Types and Data Structures - Principles, and Patterns. Sorting and Selection – Linear Sorting –Divide and Conquer based sorting - Merge Sort - Quick Sort. Arrays and sparse matrices representation, Linked Lists and Recursion: Using Arrays - Lists - Array based List Implementation – Linked Lists – LL ADT – Singly Linked List – Doubly Linked List – Circular Linked List Stacks and Queues: Stack ADT - Array based Stacks, Linked Stacks – Implementing Recursion using Stacks, Stack Applications. Queues - ADT, Array based Queue, Linked Queue, Double-ended queue, Circular queue, applications.

Unit 2

Trees: Tree Definition and Properties – Tree ADT - Basic tree traversals - Binary tree - Data structure for representing trees – Linked Structure for Binary Tree – Array based implementation. Introduction to Merkle Trees and Dat – Data distribution tool. Priority queues: ADT – Implementing Priority Queue using List – Heaps. Maps and Dictionaries: Map ADT – List based Implementation – Hash Tables - Dictionary ADT, Bloom filter and its variance. Skip Lists – Implementation – Complexity.

Unit 3

Search trees – Binary search tree, AVL tree, tries- splay trees, 2-3 Trees. Threaded binary trees, Tree based indexing- B trees and B+ trees. Implementation. External Memory Sorting and Searching. Graphs: ADT- Data structure for graphs - Graph traversal- Transitive Closure- Directed Acyclic graphs - Weighted graphs – Shortest Paths - Minimum spanning tree – Greedy Methods for MST.

Text Book

1. *Goodrich MT, Tamassia R, Goldwasser MH. Data Structures and Algorithms in Python. John Wiley & Sons Ltd; 2013.*

Reference(s)

1. *Goodrich MT, Tamassia R, Goldwasser MH. Data Structures and Algorithms in Java. Sixth edition, John Wiley & Sons Ltd; 2014.*
2. *Tremblay JP, Sorenson PG. An Introduction to Data Structures with Applications. Second Edition, McGraw Hill Education; 2017.*
3. *Shaffer CA. Data Structures and Algorithm Analysis in JAVA. Third Edition, Dover Publications; 2011.*
4. *Robert Lafore, Data Structures and Algorithms in JAVA, Second Edition, Pearson; 2017.*

24CYS283	DATA STRUCTURES AND ALGORITHMS LAB	L-T-P-C:0-0-3-1

Pre-Requisite(s): 24CYS181 Computer Programming Lab

Course Objectives

- To implement basic linear and non-linear data structures and their major operations.
- To implement applications using the right data structures.
- To implement algorithms for various sorting techniques

Course Outcomes

CO1: Implementing concepts and functionalities of Data Structures efficiently.
CO2: Analyzing the time complexity of implemented algorithms.
CO3: Implement linear and non-linear data structures using linked lists.
CO4: Design and apply various data structures such as stacks, queues, trees, graphs, etc. to solve various computing problems.
CO5: Implement various kinds of searching and sorting techniques.
CO6: Identify and use a suitable data structure and algorithm to solve a real-world problem.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												1	
CO2			3	2									3	
CO3	2		3										3	
CO4	1		2	3									2	1
CO5	1	2	2	1									1	2
CO6			3	2									2	2

Syllabus

List of data structures and algorithms to be implemented:

1. *Implementation of linear sorting, and Divide and Conquer based sorting algorithms*
2. *Array and Linked list implementation of List, Stack and Queue ADTs.*
3. *Doubly linked list and circular linked list*
4. *Applications of List, Stack and Queue ADTs.*
5. *Array based and linked structure-based implementation of Binary Tree operations*

6. *Implementation of Merkle Trees*
7. *Implementation of priority queues-heaps*
8. *List based implementation of hash tables*
9. *Implementation of skip lists*
10. *Implementation of binary search trees, AVL trees and Splay trees*
11. *Implementation of graph traversals*

Text Book

Goodrich MT, Tamassia R, Goldwasser MH. Data Structures and Algorithms in Python. John Wiley & Sons Ltd; 2013.

Reference(s)

1. *Tremblay JP, Sorenson PG. An Introduction to Data Structures with Applications. Second Edition, McGraw Hill Education; 2017.*
2. *Bradley N Miller, David L Ranum, Problem Solving with Algorithms and Data Structures Using Python. Franklin, Beedle and Associates; 2006.*

24CYS284	ANDROID APPLICATION DEVELOPMENT	L-T-P-C:0-0-3-1

Pre-Requisite(s): 24CYS204– Advanced Programming and 24CYS203- Operating System

Course Objectives

- This course covers the fundamentals of Android programming using the Android SDK.
- To provide and discuss various techniques and tools to develop & deploy Android Applications.
- To demonstrate various applications of Android programming and its practical implications.

Course Outcome

CO1: Demonstrate their understanding of the fundamentals of Android operating systems.

CO2: Able to use Android software development tools.

CO3: Design and develop software with reasonable complexity on mobile platform.

CO4: Ability to debug the programs and deploy the software to mobile devices.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1	2	3		1						1	2
CO2	1		3	3	3		1						2	2
CO3	1		3	3	3		1						2	2
CO4	1		2	3	3		1						3	3

Syllabus

Introduction to Android OS and App Development - Architecture, Types of Applications, Building an App, Understanding Activities, Activity Lifecycle, Managing State. Understanding various layouts and UI controls, Intents - Explicit, Implicit, Basic of Data Storage - SQLite, Shared Preferences. Understanding Broadcast receivers and Content Providers. Basic of Connecting Web APIs, Basic of Working in Background - Services, Async Tasks, GPS and GoogleMaps, Sensors.

Text Book(s)

1. *Y. Karim, Embedded Android, O'Reilly Media, First Edition; 2013.*
2. *Michael Burton, Android Application Development for Dummies, Third Edition, Wiley; 2015.*

Reference(s)

1. *Pradeep Kothari, Android Application Development Black Book, Dreamtech Press; 2014*

CIR Course - BTech

23LSE211	Life Skills for Engineers II	L-T-P-C: 1-0-2-2

Pre-requisite: An inquisitive mind, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Aid them in developing their problem solving and reasoning skills
- Facilitate them in improving the effectiveness of their communication

Course Outcomes

CO1 - Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.
CO2 - Soft Skills: To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
CO3 - Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.
CO4 - Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To learn to use more appropriate words in the given context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.
CO6 - Verbal: To be able to read texts critically and arrive at/ predict logical conclusions. To learn to organize speech and incorporate feedback in order to convey ideas with better clarity.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3	3		3
CO2									2	3		3
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication
Presentations: Need, importance, preparations, research and content development, structuring and ensuring flow of the presentation. Ways and means of making an effective presentation: Understanding and connecting with the audience – using storytelling technique, managing time, appropriate language, gestures, posture, facial expressions, tones, intonations and grooming. Importance of practice to make an impactful presentation.

Aptitude

Problem Solving II
Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.
Logarithms, Inequalities and Modulus: Basics
Time and Work: Basics, Pipes & Cistern, and Work Equivalence.
Time, Speed and Distance: Basics, Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks.

Logical Reasoning: Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives.

Verbal

Vocabulary: Aid students learn to use their vocabulary to complete the given sentences with the right words. Usage of more appropriate words in different contexts is emphasized.
Grammar (**Basic-intermediate**): Help students master usage of grammatical forms and enable students to identify errors and correct them.
Reasoning: Emphasize the importance of avoiding the gap (assumption) in arguments/ statements/ communication.
Reading Comprehension (**Basics**): Introduce students to smart reading techniques and help them understand different tones in comprehension passages.
Speaking Skills: Make students be aware of the importance of impactful communication through individual speaking activities in class.
Writing Skills: Introduce formal written communication and keep the students informed about the etiquette of email writing.

References:

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), *"Effective Team Building: How to make * winning team"*, London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & **Co.**
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan's – GRE Comprehensive Programme
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

SEMESTER V

24CYS301	DIGITAL COMMUNICATION	L-T-P-C:3-0-0-3

Pre-Requisite(s): Nil

Course Objectives

- To introduce fundamental communication models
- To understand the fundamental principles of digital modulation and demodulation methods.
- To quantify the impact of noise and channel impairments on digitally modulated signals.
- To design digital signals and optimum receivers to combat the impact of noise and channel impairments.

Course Outcomes

CO1: Understand the fundamental principles of digital modulation and demodulation methods.

CO2: Identify and list various issues present in the design of a communication system

CO3: Apply the time domain and frequency domain concepts of signals in data communication

CO4: Design suitable error detection and error correction algorithms to achieve error free data communication.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											2	2
CO2	3	2											3	3
CO3	3	2											2	2
CO4	3	2	2										2	3

Syllabus

Unit 1

Introduction to communication systems, Data, signal and Transmission: Analog and Digital, Transmission modes, Transmission Impairments, data rates for different types of multimedia data (audio, video, text), Data Rate Limits - Nyquist's and Shannon's capacity equations, Performance, Digital Transmission: Digital data over Digital channel, Analog data over Digital channel, Analog Transmission: Analog data over Analog channel, Digital data over Analog channel. Source of noises and attenuation methods- Delay Distortion, Noise, Thermal Noise, Intermediation Noise, Crosstalk Noise, Impulse Noise, Channel Capacity.

Unit 2

Transmission media Guided media, Open Wire, Twisted Pair, Optical Fiber, Unguided transmission media; Ground wave propagation, Line of sight propagation; Radio Frequencies, Microwave, Satellites, Wired LANs – Ethernet: - IEEE standards, Standard Ethernet, changes in the standard, Fast Ethernet, Gigabit Ethernet. Encoding: Line coding and Block coding, Error detection codes, Modulation: Digital to Analog and Analog to Analog conversion techniques Bandwidth utilization techniques: Multiplexing: Frequency division, Time division and Wave division multiplexing, spread spectrum concepts, Code division multiple access, digitization of wave forms, PCM, digital modulation techniques- ASK, PSK, FSK and its variants.

Unit 3

Information Theory: Measure of Information, Entropy, Discrete and Continuous channel, Shannon's encoding algorithms, Error Detection and Correction: Block Coding, Linear Block Codes, hamming distance, Cyclic Codes, Checksum – CRC - capabilities of CRC, FEC: Hamming code, constant ratio code, convolutional Code-Threshold decoding, Sequential decoding, Viterbi decoding.

Text book(s)

1. *John G. Proakis and Masoud Salehi, Digital Communications. Fifth Edition. McGraw Hill Education; 2014.*
2. *Simon Haykin, Digital Communication Systems, John Wiley & Sons; 2014.*

Reference(s)

1. *Bruce Carlson, Paul.B. Crilly, Janet.C. Ruteledge, Communication Systems, Fourth Edition McGraw-Hill; 1993.*
2. *Rodger. E. Ziemer, William. H. Tranter, Principle of Communication, Fifth Edition, John Wiley; 1998*
3. *Behrouz A. Forouzan, Data Communication and Networking, 5th Edition, McGraw Hill; 2012*

24CYS302	SECURE CODING	L-T-P-C:3-0-3-4

Pre-Requisite(s): 24CYS113 Computer Programming and 24CYS213 System Security

Course Objectives

- This course facilitates learning various techniques for systems and applications programmers to write code securely, as well as to find and mitigate vulnerabilities in existing code.

Course Outcomes

CO1: Understand the common security threats in software applications.

CO2: Identify and mitigate the vulnerabilities due to string manipulation errors.

CO3: Identify and mitigate the vulnerabilities based on dynamic memory management errors and integer operations.

CO4: Identify and mitigate the vulnerabilities due to errors in formatted output functions and concurrency.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				1	1						3	3	1
CO2	3	2	3	2	1	2		2				3	3	1
CO3	3	2	3	2	1	2		2				3	3	1
CO4	3	2	3	2	1	2		2				3	3	1

Syllabus

Introduction - Gauging the threat – Security concepts - SetUID Programs. Strings - Common String Manipulation errors - Improperly Bounded String Copies - Off-by-One Errors - Null-Termination Errors - String Truncation - String Errors without Functions - String vulnerabilities - Buffer Overflow - Process memory organization – Stack management - Stack smashing – Mitigation techniques – String handling functions – Runtime protection strategies.
Dynamic Memory Management – C Memory management functions - Common C Memory Management Errors – Initialization Errors - Failing to Check Return Values - Dereferencing Null or Invalid Pointers - Referencing Freed Memory - Freeing Memory Multiple Times - Memory Leaks - Zero-Length Allocations - Mitigation Strategies. Integer Security – Introduction to integer types - Integer Data Types - Integer Conversions – Integer operations - Integer Vulnerabilities – Mitigation strategies.
Formatted Output - Variadic Functions - Formatted Output Functions - Vulnerabilities - Mitigation Strategies. Concurrency - Common Errors - Race Conditions – File I/O - TOCTOU – Mitigation strategies.

Textbooks:

1. *Robert C. Seacord, Secure Coding in C and C++, 2nd Edition, Addison-Wesley, 2013.*

References:

1. *CERT C Coding Standard. Available online: https://wiki.sei.cmu.edu/confluence/display/c/SEI+CERT+C+Coding+Standard.*
2. *Wenliang Du, Computer Security – A hands-on Approach, Second Edition, Create space Independent Pub; 2019.*

24CYS303	ALGORITHMS: DESIGN AND ANALYSIS	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS215- Data Structures and Algorithms

Course Objectives

- To provide the fundamentals of algorithm design and analysis, specifically in terms of design techniques, application of these design techniques for real-world problem solving and analysis of complexity and correctness of algorithms.
- To provide understanding of how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.
- To explain various computational models, order notation and complexity measures to analyse complexity & performance of algorithms associated with real-world problems.

Course Outcomes

CO1: Evaluate the correctness and analyze complexity of algorithms.

CO2: Understand and implement various algorithmic design techniques and solve classical problems.

CO3: Design solutions for real world problems by identifying, applying and implementing appropriate design techniques.

CO4: Analyze the impact of various implementation choices on the algorithm complexity.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2								1	1
CO2	3	3	2	3	3								2	2
CO3	2	2	3	2	2								2	2
CO4	2	2	1	3	3								1	1

Syllabus

Unit 1

Role of Algorithm in Computing. Space and Time Complexity, Rate of growth of functions. Basic complexity analysis – Best, Worst, and Average Cases, Asymptotic notations. Recurrence relations and methods to solve them: Recursion tree, Substitution, Master Method. Analysis of Sorting algorithms - Bubble, Insertion, Selection and Heap Sort. Graph Algorithms – Graph Traversal: BFS, DFS, Its Applications, Topological sort, Strongly Connected Components. Path algorithms: Shortest path algorithms (along with analysis) SSSP: Bellman Ford. APSP: Floyd Warshall Algorithm. Minimum Spanning Tree- Kruskal's, Prims, its analysis.

Unit 2

Divide and Conquer: Merge Sort and Binary search type strategies, Pivot based strategies. Strassens's Algorithm for matrix multiplication, Long integer multiplication – Maximum subarray sum - Closest Pair problem as examples. Greedy Algorithm - Introduction to the method, Fractional Knapsack problem, Task Scheduling Problem, Huffman coding as examples. Dynamic Programming: Introduction to the method, Fibonacci numbers, 0-1 Knapsack problem, Matrix chain multiplication problem, Longest Common Subsequence, and other problems including problems incorporating combinatorics as examples.

Unit 3

Backtracking, Branch and Bound 0-1 Knapsack, N-Queen problem, subset sum as some examples. String Matching: Rabin Karp, Boyer Moore, Knuth-Morris-Pratt (KMP). Network Flow and Matching: Flow Algorithms - Maximum Flow - Cuts Maximum Bipartite Matching. Introduction to NP class: Definitions P, NP, NP complete, NP hard, Examples of P and NP.

Text Book

1. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein. Introduction to Algorithms, Third Edition, The MIT Press Cambridge, Massachusetts; 2009 (Indian reprint: Prentice-Hall).*

Reference(s)

1. *Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples. John Wiley and Sons; 2001.*
2. *Dasgupta S, Papadimitriou C and Vazirani U. Algorithms, Eighth Edition, Tata McGraw-Hill; 2009.*
3. *Jon Kleinberg, Eva Tardos. Algorithm Design, First Edition, Pearson New International Edition, Pearson Education Limited; 2014.*

24CYS304	COMPUTER NETWORKS	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS104 - Computer Hardware and System Essentials

Course Objectives

- This course introduces the fundamental principles of computer networks including important layers and protocols
- This course will focus on the most important layers including transport layer and link layer along with their functionalities.
- This course will help students with network programming and debugging capabilities.

Course Outcomes

CO1: Understand the basic architectural components of computer networks and apply mathematical foundations to solve computational problems in computer networking.

CO2: Apply network application services, protocols and programming.

CO3: Analyze protocols for data transfer mechanisms, buffer management and flow handling mechanisms.

CO4: Analyze devices for routing and apply routing protocols.

CO5: Apply and Analyze network access protocols and error handling codes to design Local Area Network.

CO6: Comprehend concepts of virtualization and data centric networking.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	4	4	2	1										
CO2	3	2	4	1	3								2	
CO3	2	1	3	2	4							1		
CO4		2	1	2	4								1	
CO5		2	2	3	4									
CO6		2	1	3	3								1	

Syllabus

Unit 1

The Internet-The Network Edge, the Network Core, Network Topology, Types of Networks, Delay, Loss, and Throughput in Packet Switched Networks. Protocol Layers and their Service Models. Principles of Network Applications: The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS, Peer-to-Peer Applications. Introduction and Transport Layer Services: Multiplexing and demultiplexing, Connectionless Transport - UDP, Principles of Reliable Data Transfer.

Unit 2

Transport layer - Connection Oriented Transport - TCP, Principles of Congestion Control, TCP Congestion Control. Introduction Network Layer: Virtual Circuit and Datagram Networks, Inside a Router, The Internet Protocol (IP) - Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing.

Unit 3

The Link Layer and Local Area Networks - Introduction and Services, Error-Detection and Correction Techniques, Multiple Access Protocols - Link-Layer Addressing, Ethernet, Link-Layer Switches– Case Study: Virtualization and data center Networking.

Text Book

1. *Kurose J F and Ross K W. Computer Networking: A Top-Down Approach. Seventh Edition, Pearson Press, 2017.*

Reference(s)

1. *Tanenbaum A S. Computer Networks. Fifth Edition, Pearson Education India; 2013.*
2. *Stallings W. Data and computer communications. Tenth Edition, Pearson Education India; 2013.*
3. *Forouzan B A. Data Communication and Networking. Fourth Edition, Tata McGraw Hill; 2017.*

24CYS381	COMPUTER NETWORKS LAB	L-T-P-C: 0-0-3-1

Pre-Requisite(s): 24CYS104 - Computer Hardware and System Essentials

Course Objectives

- To be familiarized with the use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To use simulation tools to analyze the performance of various network protocols.

Course Outcomes

CO1: Hands on training regarding the design, troubleshooting, modelling and evaluation of computer networks.

CO2: Perform simulations that will help them evaluate their design approaches and expected network performance.

CO3: Use simulation tools to analyze the performance of various network protocols.

CO4: Analyze and simulate various routing algorithms.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					3		1							1
CO2				2	3		1						2	1
CO3				2	3		1						2	1
CO4					3		1						2	1

Syllabus

List of Experiments:

1. Basic Networking commands.
2. Socket Programming - Client server communication using sockets (TCP and UDP)
3. Implementation of unicast, broadcast and multicast Communication
4. Implementation of Checksum and congestion control algorithms
5. Implementation and simulation of algorithm for routing protocols
6. Implementation of SMTP protocol using UDP
7. Development of a packet capture and filtering application using raw sockets.
8. Experimental study of Application Protocols using Network packet sniffers and analyzers.

9. Familiarization of network simulator software - Setting up a small network, Configure interfaces, IP addresses and routing Protocols.
10. Setting up a Network LAN with subnetting and CIDR concept for a specific scenario.

Text Book(s)

Kurose J F and Ross K W. Computer Networking: A Top-Down Approach. Seventh Edition, Pearson Press, 2017.

Reference(s)

1. https://www.csd.uoc.gr/~hy556/material/tutorials/cs556-3rd-tutorial.pdf
2. https://www.nsnam.org/
3. https://www.wireshark.org/
4. https://www.netacad.com/courses/packet-tracer

24CYS305	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS	L-T-P-C:3-0-3-4

Pre-Requisite(s): 24MAT109 - Linear Algebra, 24CYS211 - Probability and Statistics

Course Objectives

- This course provides a comprehensive, introduction to artificial intelligence, emphasizing advanced topics such as advanced search, reasoning and decision-making under uncertainty.
- This course aims to make the learners understand the basic principles in AI and Neural Networks.

Course Outcome

CO1: Understand the fundamental of Artificial Intelligence (AI) and Neural Networks.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Apply the understanding of AI techniques in various applications of intelligent agents, expert systems, and artificial neural networks.

CO4: Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2									2	2
CO2	2	3	3	3	2								2	3
CO3	2	3	3	3	3								3	3
CO4	3	3	2	3	2	2		2		2			2	3

Syllabus

Unit 1

Introduction to AI and systems - Problem formulation, problem definition, Control Strategies, Search Strategies - Depth first, Breadth first, problem characteristics, system characteristics, problem solving methods - problem graphs, matching, indexing, heuristic functions, A* search algorithm, Hill climbing, Constraint satisfaction - related algorithms, handling uncertainty in terms of probability, measure of performance**.**

Unit 2

Knowledge representation - Game playing - Predicate logic, Introduction to Predicate calculus, Resolution, use of predicate calculus, Knowledge representation using other logic - Structured representation of knowledge. Knowledge inference - Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach. Planning and machine learning - Basic plan generation systems

Unit 3

Perceptrons - classification - limitations of linear nets and perceptrons - Multi-Layer Perceptrons (MLP) - activation functions - linear, softmax, Tanh, ReLU; error functions – feed - forward networks - Back propagation - recursive chain rule (back propagation) - Learning weights of a logistic output - Loss functions - learning via gradient descent - optimization - momentum method; Adaptive learning rates – RmsProp - mini-batch gradient descent - bias-variance trade off, regularization - overfitting - inductive bias – regularization - drop out - generalization. Probabilistic Neural Network - Auto-encoders. Brief introduction to Deep Learning and Adversarial Neural Networks – CNN – RNN – Deep Generative Models (GAN).

Text Book

Stuart J. Russell, Peter Norvig. Artificial Intelligence: A Modern Approach Prentice-Hall, Inc., 2009.

Reference(s)

1. *Hawkins J, Blakeslee S. On intelligence: How a new understanding of the Brain Will lead to the creation of Truly Intelligent Machines. Macmillan; 2004*
2. *Rich Elaine, Kevin Knight, B. Shivashankar Nair. Artificial Intelligence 3E (Sie). India, Tata McGraw-Hill Publ., 2019.*
3. *Dean, T., Allen, J. & Aloimonos, Y. Artificial Intelligence Theory and Practice. New York: Benjamin Cummings;1995.*
4. *Ginsberg M. Essentials of Artificial Intelligence. Newnes; 2012.*
5. *Luger, G. F.,Stubblefield, W. A. Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, Fifth edition;2005.*

23LSE301	Life Skills for Engineers III	L-T-P-C: 1-0-2-2

Pre-requisite: Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students understand corporate culture, develop leadership qualities and become good team players
- Assist them in improving group discussion skills
- Help students to sharpen their problem solving and reasoning skills
- Empower students to communicate effectively

Course Outcomes

CO1 - Soft Skills: To improve the inter-personal communication and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.
CO2 - Soft Skills: To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.
CO3 - Aptitude: To identify, investigate and arrive at appropriate strategies to solve questions on geometry, statistics, probability and combinatorics.
CO4 - Aptitude: To analyze, understand and apply suitable methods to solve questions on logical reasoning.
CO5 - Verbal: To be able to use diction that is more refined and appropriate and to be competent in spotting grammatical errors and correcting them.
CO6-Verbal: To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3	2	3
CO2										3	2	2
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Professional Grooming and Practices: Basics of corporate culture, key pillars of business etiquette – online and offline: socially acceptable ways of behavior, body language, personal hygiene, professional attire and Cultural adaptability and managing diversity. Handling pressure, multi-tasking. Being enterprising. Adapting to corporate life: Emotional Management (EQ), Adversity Management, Health consciousness. People skills, Critical Thinking and Problem solving.
Group Discussions: Advantages of group discussions, Types of group discussion and Roles played in a group discussion. Personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

Aptitude

Problem Solving III

Geometry: 2D, 3D, Coordinate Geometry, and Heights & Distance.
Permutations & Combinations: Basics, Fundamental Counting Principle, Circular Arrangements, and Derangements.
Probability: Basics, Addition & Multiplication Theorems, Conditional Probability and Bayes' Theorem.
Statistics: Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

Logical Reasoning: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding \& Decoding, Cryptarithmetic Problems and Input - Output Reasoning.

Verbal

Vocabulary: Create an awareness of using refined language through idioms and phrasal verbs.
Grammar (**Upper Intermediate-Advanced**): Train Students to comprehend the nuances of Grammar and empower them to spot errors in sentences and correct them.
Reasoning: Enable students to connect words, phrases and sentences logically.
Oral Communication Skills: Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.
Writing Skills: Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style.

References:

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), *"Effective Team Building: How to make * winning team"*, London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & **Co.**
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
16. A Modern Approach to Logical Reasoning, R S Aggarwal.
17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

23ENV300 **ENVIRONMENTAL SCIENCE** **P/F**

Course Objectives

- To study the nature and facts about environment
- To appreciate the importance of environment by assessing its impact on the human world
- To study the integrated themes and biodiversity, pollution control and waste management

Course Outcomes

CO1: Ability to understand aspects of nature and environment
CO2: Ability to analyse impact of environment on human world
CO3: Ability to comprehend pollution control and waste management

CO – PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO2	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	2	3	-	-	-	-	-	-

Syllabus
Unit 1

Over view of the global environment crisis – Biogeochemical cycles – Climate change and related international conventions and treaties and regulations – Ozone hole and related International conventions and treaties and regulations – Overpopulation – energy crisis – Water crisis – ground water hydrogeology – surface water resource development.

Unit 2
Ecology, biodiversity loss and related international conventions – treaties and regulations – Deforestation and land degradation – food crisis – water pollution and related International and local conventions – treaties and regulations – Sewage domestic and industrial and effluent treatment – air pollution and related international and local conventions – treaties and regulations – Other pollution (land, thermal, noise).

Unit 3
Solid waste management (municipal, medical, e-waste, nuclear, household hazardous wastes) – environmental management – environmental accounting – green business – eco-labelling – environmental impact assessment – Constitutional – legal and regulatory provisions – sustainable development.

Text Book(s)
R. Rajagopalan,"Environmental Studies – From Crisis to Cure", Oxford University Press, 2005, ISBN 0-19-567393-X.

Reference(s)
G.T.Miller Jr., "Environmental Science", 11th Edition, Cenage Learning Pvt. Ltd., 2008.
Benny Joseph, "Environmental Studies", Tata McGraw-Hill Publishing company Limited, 2008.

Evaluation Pattern

Assessment	Internal	End Semester
Midterm Exam	30	
*Continuous Assessment (CA)	30	
End Semester/Projects		40

•CA – Can be Quizzes, Assignment, Projects, and Reports

23LIV390	LIVE – IN – LABS-I	L-T-P-C:3

Course Objectives

- Identify and analyse the various challenge indicators present in the village by applying concepts of Human.
- Centered Design and Participatory Rural Appraisal.
- User Need Assessment through Quantitative and Qualitative Measurements
- Designing a solution by integrating Human Centered Design concepts
- Devising proposed intervention strategies for Sustainable Social Change Management

Course Outcome

CO1: Learn ethnographic research and utilise the methodologies to enhance participatory engagement.

CO2: Prioritize challenges and derive constraints using Participatory Rural Appraisal.

CO3: Identify and formulate the research challenges in rural communities.

CO4: Design solutions using human centered approach.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3		3		1	1		3	3		3		
CO2		3						3	3	3				
CO3		3					1		3	3		3		
CO4	3		3				3	3	3	3		3		

Syllabus

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- *Agriculture & Risk Management*
- *Education & Gender Equality*
- *Energy & Environment*
- *Livelihood & Skill Development*
- *Water & Sanitation*

- *Health & Hygiene*
- *Waste Management & Infrastructure*

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.

Evaluation Pattern

ASSESSMENT	MARKS
Internal (Continuous Evaluation) [75 Marks]	
Workshop (Group Participation)	15
Village Visit Assignments and Reports	15
Problem Identification and Assessment	15
Ideation: Defining the Needs, Proposed Designs & Review	20
Poster Presentation	10
External [25 Marks]	
Research Paper Submission	25
Total	**100**
Attendance (To be added Separately)	**5**
Grand Total	**105**

SEMESTER VI

24CYS311	CYBER FORENSICS	L-T-P-C:2-0-3-3

Pre-Requisite: 24CYS101 - Cyber Security Essentials

Course Objectives

- To provide the fundamentals of digital and cyber space, impact of the activities.
- To cover the fundamentals of cyber-crime and steps involved in collecting the evidences through various tools.
- To provide basics of Cyber-crime incidents and how Cyber Law address them.

Course Outcomes

CO1: Explain the concept of digital forensics and cyber forensics

CO2: Understand and able to perform cyber forensics for the cybercrime incident

CO3: Able to use different forensics tools and standard to report the real-world cyber incidents

CO4: Familiarizing the fundamentals of Anti-forensics and Cyber laws

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1									2	2
CO2	2	3	3	3	2	2		2	2	2		2	3	3
CO3	3	3	3	3	3	2		2	2	2		2	3	3
CO4	2	2	2	3	2	3		3	2	3		3	2	2

Syllabus

Unit 1

Classifications of Cyber Crimes against individuals, property and nation, Need for Digital forensics and steps in digital forensics (scientific methods), Number System: Binary, Decimal, Hexadecimal, ASCII, and Unicode representation of data, Arenas for digital forensics: disk, network, wireless, database, mobile, e-mail, GPS and memory, Incident handling and response with forensic triage, Ethical Hacking and future of cybercrime.

Unit 2

Locard's exchange principle and digital forensic investigation models, types: artifacts, identifying raw and proprietary forensic storage formats, identification of potential evidence: slack space, swap space,

steganography, recovery of hidden, deleted and corrupt data, standard file formats with their headers and forensic file carving, planning your investigation, order of volatility and forensic triage, overview of file systems.

Unit 3

Rules of collecting Digital Evidence, Standard collection procedures: seizure, write blockers, bit-stream imaging, hashing, Chain of Custody (COC), evidence bags and SOP for collecting evidences, Source and Location of Digital Evidences, Duplicating and Preserving Digital Evidences, Importance of MAC timings, Types of System logs and Windows Registry.

Unit 4

Forensic laboratory requirements: setting up of lab, evaluating lab staff, selection of appropriate forensic workstations, backup and recovery plans, generating forensically sound reports., IPR and Cyber Laws in India - IT Act 2000 and 2008 Amendment and like-minded IPC sections, Code of Ethics, Expert Witness and analyzing sample forensic reports.

Unit 5

Validating and gathering evidence using DOS Commands and Unix/Linux Commands, Forensic imaging using DD commands, Software tools - Open Source and proprietary digital forensic frameworks, Hardware tools - write blockers, images and evidence protection containers/bags, NIST tools - CFReDS, CTFF and NSRL and analyzing e-mail headers and network packets.

Textbook(s)

1. *E. Casey, Handbook of Digital Forensics and Investigation, Academic Press; 2010.*
2. *David Cowen, Computer Forensics: A Beginners Guide, McGraw Hill Education; 2013.*
3. *Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Fourth Edition; 2014.*

Reference(s)

1. *Brian Carrier, File System Forensic Analysis, Pearson, 2006.*
2. *Marjie T. Britz, Computer Forensics and Cyber Crime, Pearson, 2012.*

24CYS312 PRINCIPLES OF PROGRAMMING LANGUAGES L-T-P-C:2-0-3-3

Pre-Requisite(s): 24CYS113 Computer Programming, and 24CYS204 Advanced Programming

Course Objectives

- This course provides a quick overview of different paradigms of programming languages.
- It focuses primarily on the functional programming paradigm using Haskell & Rust.

Course Outcomes

CO1: Understand and implement pure functional programs in Haskell

CO2: Understand and implement programs in Rust

CO3: Formulate abstractions with higher order procedures.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	2								2	2
CO2	2	3	3	3	2								2	2
CO3	2	3	2	3								2	3	3

Syllabus

Programming Paradigms - Overview of various Programming Paradigms. Functional Programming with Haskell - GHCi interpreter - functions and types, functional composition, numbers, lists, tuples, type classes, pattern matching, higher order functions: currying, lambdas, maps and filters, folds, IO monad.
Introduction to Rust - Data types, Operators, Decision Making, Loops, Functions, Tuple and Array, Ownership, Borrowing, Slices, Structure, Modules, Collections, Error Handling, File Input and Output, Package Manager, Iterator and Closure, References, Concurrency - Basics of RUST and Memory safe.

Text Book(s)

1. *Bird R. Thinking functionally with Haskell. Cambridge University Press; 2014.*
2. *Jim Blandy and Jason Orendorff. Programming Rust. First Edition, O'Reilly Media; 2018*

Reference(s)

1. *Graham Hutton. Programming in Haskell. Second Edition, Cambridge University Press;2016*
2. *Steve Klabnik, Carol Nichols. The Rust Programming Language. No Starch Press; 2018*

24CYS313	NETWORK SECURITY	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS304 - Computer Networks

Course Objectives

- This Course provides the understanding about the fundamental concepts of Network Security.
- To transfer a message securely over insecure channel.
- To be able to maintain the confidentiality, Integrity and Availability of data transferred over a Network.

Course Outcome

CO1: Understand various techniques for Network Protection and explore new tools and attacks in network security domain.

CO2: Familiarize the LAN based attacks and their mitigations.

CO3: Exploring Secure Network Communication protocols and attacks.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		3	3	3								3	3
CO2	1		3	2	3								2	3
CO3	1		3	3	3								3	3

Syllabus

Unit 1

Techniques for Network Protection, Monitoring and Detection: Firewalls, packet filter and stateful firewalls, application aware firewalls, personal firewalls-IPtables, Proxies, NAT, Intrusion Detection System-Snort, Signature and Anomaly based detection, Honeypots and Honeynets, Network Log management-syslog or SPLUNK; RBAC: Role mining; DNS-Dig tool: DNSSEC-DS and NSEC records.

Unit 2

Protocols and Standards: SCP, SSH, SSL3.0, TLS 1.2, STARTTLS, IPSec, VPN and Secure HTTP; Encrypting and Signing Emails: PGP- GPG/open PGP, DKIM and SPF; Single Sign On (SSO)-OAUTH and OPENID.

Unit 3

Attack Techniques: Network reconnaissance-Nmap and vulnerability audits-openVAS; DNS based attacks, Phishing-DNSTwist; Network based malware attacks: Remote access Trojan-Poison Ivy and Domain name generation algorithm based Botnets; LAN attacks: ARP Cache poisoning- Ettercap/arpspoof, MAC flooding, Man in the middle attacks, Port Stealing, DHCP attacks, VLAN hopping; Network Sniffing - Wireshark and Password Cracking-John the Ripper; Attacks on SSL/TLS: SSL stripping, Drown and Poodle attack; Network packet creation and Manipulation using scapy and dpkt libraries.

Text Books

1. *William Stallings, Cryptography and Network Security: Principles and Practice,8th Edition, Pearson edition, 2020.*
2. *Behrouz A. Forouzan, Cryptography & Network Security, McGraw-Hill, 3rd Edition 2015.*

References:

1. *W. Stallings, Network Security Essentials: Applications and Standards,6th Edition, Pearson Prentice Hall, 2016.*
2. *Bryan Sullivan and Vincent Liu, Web Application Security, A Beginner's Guide, McGraw-Hill Education, 2012*
3. *C. Kaufman, R. Perlman and M. Speciner, Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall PTR, 2002.*

24CYS314	APPLIED CRYPTOGRAPHY	L-T-P-C:3-1-0-4

Pre-Requisite(s): 24CYS114 Classical Cryptography and 24CYS206 Modern Cryptography

Course Objectives

- The course will provide mechanisms and properties of cryptographic protocols that establish and maintain security properties of information exchange in two-party and multiparty settings within ambient open communications networks.

Course Outcome

CO1: Acquire an overview and understanding of the problems, notions, definitions, design principles and proof techniques for selected cryptographic protocols.

CO2: Evaluate a given security protocol against the state of the art.

CO3: Understanding and analyzing some typical applications of cryptographic protocols in networked systems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2								2	
CO2		3		3									3	2
CO3	2	2	2	1									3	2

Syllabus

Protocols for identification and login: Interactive protocols, ID protocols, Password protocols, Challenge-response protocols, Schnorr's identification protocol, Proving properties in zero-knowledge.
Authenticated Key Exchange: Goals for authentication and Key Establishment, encryption-based protocol and its attacks, Perfect forward secrecy, Protocol based on ephemeral encryption, Attacks on Insecure variations, Identity protection, One-sided authenticated key exchange, Security of protocol AKE1, Password authenticated key exchange - Phishing attacks, Protocol PAKE0, Protocol PAKE1, Protocol PAKE2, Explicit key confirmation. Key exchange protocol with an online TTP, Insecure variations of protocol Online TTP
Classes of Key Agreement protocols: Diffie Hellman Key Agreement, MTI Protocols, Diffie Hellman-Based Protocols. Protocols not based on Diffie Hellman.
Pairing based cryptographic protocol: ID based encryption schemes, Boneh and Franklin's Scheme, Shamir's encryption and signature schemes.
Conference Key protocols: Security goals, Static and dynamic groups, Generalizing Diffie-Hellman key agreement.

Text Books:

1. *Boyd, Colin, Anish Mathuria, and Douglas Stebila. Introduction to Authentication and Key Establishment. Protocols for Authentication and Key Establishment. Springer, Berlin, Heidelberg; 2020*

2. *Boneh, Dan, and Victor Shoup. A graduate course in applied cryptography. Draft 0.5; 2020*

References:

1. *J. Menezes, P. C. V. Oorschot and S. A. Vanstone, Handbook of Applied Cryptography, CRC Press, 1996.*
2. *J. Pieprzyk, T. Hardjono and J. Seberry, Fundamentals of computer security, Springer; 2003.*
3. *Abhijit Das and Veni Madhavan C. E., Public-key Cryptography, Theory and Practice, Pearson Education; 2009.*
4. *L. Dong and K. Chen, Cryptographic Protocol: Security Analysis Based on Trusted Freshness, Springer; 2012.*

24CYS315 AUTOMATA THEORY AND COMPILER DESIGN L-T-P-C:3-0-3-4

Pre-Requisite(s): 24CYS215 - Data Structures and Algorithms

Course Objectives

- To provide an overview of the problems that can be solved by various kinds of abstract machines such as finite state machine and pushdown automata.
- To understand how lexical analysis and syntax analysis are done using regular expressions and context free grammars respectively.
- To understand various intermediate representations and code generation algorithms for compiler design.

Course Outcome

CO1: Design and development of various finite state machines and regular expressions.

CO2: Apply the concepts of finite automata and regular expressions for the lexical analysis of a program.

CO3: Demonstrate the push down automata and context free grammar to recognize Context free languages and apply the same for syntax analysis or parsing.

CO4: Generate intermediate code and target code for a simple compiler.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	1								1	2
CO2	2	2	3	3	2								1	3
CO3	2	2	3	3									2	3
CO4	3	3	3	3	2								2	3

Syllabus

Unit 1

Finite State Machines: Deterministic Finite Automata (DFA) - Non-Deterministic Finite Automata (NFA) - Equivalence of NFA and DFA - Minimization of DFA - Regular Expression Regular Language - Properties of Regular Languages - Definition of a compiler - phases of compiler - Lexical Analysis.

Unit 2

Context Free Languages (CFL) and Parsing: Pushdown Automata - Context Free Grammar (CFG) - Properties of CFL - Normal Forms - Syntax analysis - top-down parser - Non recursive predictive parser - Bottom-up parser – SLR - CLR.

Unit 3

Intermediate Representations: Abstract Syntax Tree, Three Address Code - Symbol Tables - Basic blocks - Flow graphs. Code generation: A simple code generation Algorithm - code generation.

Text Book(s)

1. *Linz P, An Introduction to Formal Languages and Automata. Sixth edition, Jones and Bartlett Learning; 2016.*
2. *Cooper, Keith, and Linda Torczon, Engineering a Compiler, Second Edition, Morgan Kaufman, 2011.*

Reference(s)

1. *Hopcroft JE, Motwani R, Ullman JD. Introduction to Automata Theory, Languages and Computation. Third Edition, Pearson; 2006.*
2. *Aho, Alfred V., Monica S. Lam, Ravi Sethi, and Jeffrey Ullman, Compilers: Principles, Techniques and Tools, Prentice Hall, Second Edition, 2006*
3. *Parr T. Language implementation patterns: create your own domain-specific and general programming languages. Pragmatic Bookshelf; First Edition, 2010.*
4. *Mak R. Writing compilers and interpreters: a software engineering approach. John Wiley & Sons; Third Edition, 2009.*

CIR Course - BTech

23LSE311	Life Skills for Engineers IV	L-T-P-C: 1-0-2-2

Pre-requisite: Self-confidence, presentation skills, listening skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students prepare resumes and face interviews with confidence
- Support them in developing their problem-solving ability
- Assist them in improving their problem solving and reasoning skills
- Enable them to communicate confidently before an audience

Course Outcomes

CO1 - Soft Skills: To acquire the ability to present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.
CO2 - Soft Skills: To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.
CO3 - Aptitude: To manage time while applying suitable methods to solve questions on arithmetic, algebra and statistics.
CO4 - Aptitude: To investigate, understand and use appropriate techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To use diction that is less verbose and more precise and to use prior knowledge of grammar to correct/improve sentences.
CO6 -Verbal: To understand arguments, analyze arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2								2	3	3		2
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Team Work: Value of teamwork in organizations, Definition of a team. Why team? Effective team building. Parameters for a good team, roles, empowerment and need for transparent communication, Factors affecting team effectiveness, Personal characteristics of members and its influence on team. Project Management Skills, Collaboration skills.
Leadership: Initiating and managing change, Internal problem solving, Evaluation and co-ordination, Growth and productivity, Importance of Professional Networking.
Facing an interview: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good communication skills, etiquette to be maintained during an interview, appropriate grooming and mannerism.

Aptitude

Problem Solving II
Sequence and Series: Basics, AP, GP, HP, and Special Series.

Data Sufficiency: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.
Logical reasoning: Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.
Campus recruitment papers: Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.
Competitive examination papers: Discussion of previous year question papers of CAT, GRE, GMAT, and other management entrance examinations.
Miscellaneous: Interview Puzzles, Calculation Techniques and Time Management Strategies.

Verbal

Vocabulary: Empower students to communicate effectively through one-word substitution.
Grammar: Enable students to improve sentences through a clear understanding of the rules of grammar.
Reasoning: Facilitate the student to tap his reasoning skills through Syllogisms, critical reasoning arguments and logical ordering of sentences.
Reading Comprehension (**Advanced**): Enlighten students on the different strategies involved in tackling reading comprehension questions.
Public Speaking Skills: Empower students to overcome glossophobia and speak effectively and confidently before an audience.
Writing Skills: Practice formal written communication through writing emails especially composing job application emails.

References:

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), "Effective Team Building: How to make * winning team", London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. A Modern Approach to Verbal Reasoning – R.S. Aggarwal
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
16. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
17. A Modern Approach to Logical Reasoning, R S Aggarwal.
18. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

23LIV490	LIVE-IN-LABS II	L-T-P-C:0-0-0-3

Course Objectives

- Proposal writing in order to bring in a detailed project planning, enlist the materials required and propose budget requirement.
- Use the concept of CoDesign to ensure User Participation in the Design Process in order to rightly capture user needs/requirements.
- Building and testing a prototype to ensure that the final design implementation is satisfies the user needs, feasible, affordable, sustainable and efficient.
- Real time project implementation in the village followed by awareness generation and skill training of the users (villagers)

Course Outcome

CO1: Learn co-design methodologies and engage participatorily to finalise a solution

CO2: Understand sustainable social change models and identify change agents in a community.

CO3: Learn Project Management to effectively manage the resources

CO4: Lab scale implementation and validation

CO5: Prototype implementation of the solution

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3	3			1	3	3	3		3		
CO2									3	3				
CO3									3	3	3			
CO4	3		3			3	1	3	3	3		3		
CO5			1						3	3				

Syllabus

The students shall visit villages or rural sites during the vacations (after 6th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

Evaluation Pattern

ASSESSMENT	MARKS
Internal (Continuous Evaluation) [63 Marks]	
1. Proposed Implementation	2
Presentation Round 1	
2. Proposal Submission + Review	6
3. Co-design	6
Village Visit I (Co-Design Field Work Assignments)	4
Presentation of Co-design Assessment	2
4. Prototype Design	14
Prototype Design	4
Prototype Submission	8
Sustenance Plan	2
Implementation	35
Implementation Plan Review	3
5. Implementation	24
Testing & Evaluation	4
Sustenance Model Implementation	4
External [37 Marks]	
6. Research Paper	18
7. Final Report	15
8. Poster Presentation	4
Total	**100**
Attendance	**5**
Grand Total	**105**

SEMESTER VII

23CYS401	SECURE SOFTWARE ENGINEERING	L-T-P-C:2-0-3-3

Pre-Requisite(s): Nil

Course Objectives

- Understanding various system process models and build a secure environment.
- Apply vulnerability analysis into architecture and design process, access controlled and clean environment to build software, target environment hardening and secure application deployment.
- To familiarize with containerization for software development and also focus on security testing of software and software security economics

Course Outcome

CO1: Develop secure system models depending on user requirements.

CO2: Able to build analysis model and apply threat model for analysing the vulnerabilities in the system.

CO3: Understanding software security economics and practices in containerized development.

CO4: Develop security testing of software and understand basics of security governance, risk and compliance.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	3	3				2		1			
CO2		3	3	3		3		2	2		1		3	2
CO3			3	3			3	1				1	2	2
CO4			3	3			3	1				1	2	2

Syllabus

Unit 1

Process Models–Waterfall, incremental, evolutionary, concurrent, Agile Programming- Introduction, Flavors of Agile Development, Agile Manifesto, Refactoring Techniques, Limitations of the Agile Process, Agile Modeling with XP, Scrum Methodology. How sprint works: Sprint Planning, Daily scrum meeting, updating sprint backlog, Burn down chart, sprint review, sprint retrospective. Scrum Metrics- velocity, burn down, defects carried over. Secure development and build environment.

Unit 2

Requirements Engineering: Tasks Initiation-Elicitation-Developing Use Cases-Building the analysis Model-Negotiation- Validation Requirements Modelling - building the analysis model, Scenario based methods, UML Models, Data Models. Design engineering Design concepts, Design models, software architecture, architectural styles and patterns, Architectural design: styles and patterns, architectural design, Refining architecture to components. Performing user interface Design-Golden Rules-User Interface Analysis and Design- Interface Analysis-Interface design steps. Threat Modeling –STRIDE, Information flow and vulnerability model to build security into life cycle phase of software (and hardware) components, Vulnerability analysis into architecture and design process, Access-controlled and clean environment to build software, Target environment hardening and secure application deployment, Attack trees.

Unit 3

Containerized development: Docker, Kubernets, Continuous Integration and Continuous Delivery (CI/CD). Security testing of software: Unit testing, integration testing, validation and system testing, fuzzing. Software security economics- logging/ monitoring and physical and operational security aspects. Basics of security governance, risk and compliance.

Text Book

1. *Pressman R S, Bruce R. Maxim, Software Engineering - A Practitioner's Approach. Eighth Edition, McGraw-Hill Education, 2019.*

Reference(s)

1. *Crowder JA, Friess S. Agile project management: managing for success. Cham: Springer International Publishing; 2015.*
2. *Stellman A, Greene J. Learning agile: Understanding scrum, XP, lean, and kanban, O'Reilly Media, Inc.; 2015.*
3. *Rubin KS. Essential Scrum: a practical guide to the most popular agile process. Addison-Wesley; 2012.*
4. *S. Garfinkel and L. F. Cranor, Security and Usability: Designing Secure Systems That People Can Use, O'Reilly, 2008.*

24CYS402	DISTRIBUTED SYSTEMS AND CLOUD COMPUTING	L-T-P-C:2-0-3-3

Pre-Requisite(s): 24CYS203 - Operating System, 24CYS205 - Database Management System

Course Objectives

- Introduction to distributed systems and cloud computing.
- Understand different cloud architectures and technology.
- Illustrate the use of Hadoop clusters and Peer to Peer Systems

Course Outcome

CO1: Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing

CO2: Characterize the distinctions between Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS) abstractions, and Public and Private Clouds, and analyze their advantages and disadvantages.

CO3: Exploring Hadoop clusters and Peer to Peer Systems

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1	1							2	2
CO2	2	2	1		1	1							2	2
CO3	2	1	2		1	1							2	2

Syllabus

Introduction to distributed systems, Distributed computing paradigms, Inter process communication mechanisms, Process models in distributed systems, The CAP theorem, Consistency models and Replication, Consensus algorithm: Clock Synchronization – Logical clocks – Mutual Exclusion, global positioning of nodes, Distributed Commit protocols – 2PC, 3PC, Check-pointing and Recovery, Election algorithms, Failure Models, Paxos algorithm- Apache Zookeeper, Distributed file system – Eg: CODA and Ceph, Distributed storage implementation – Data sharding, nosql key value stores and its properties – Eg: Google Big Table, Amazon DynamoDB. Cloud computing benefits and its challenges, Types – Private, Public and Hybrid clouds, Models – IaaS, PaaS and SaaS. Role of virtualization in enabling the cloud computing; Business Agility: Benefits and challenges to cloud architecture. AWS cloud services and management – scalability, availability, concurrency with practical aspects, REST API services including load balancing, server authentication and debug handling, AWS Zelkova for Provable Security. Hadoop cloud computing framework – HDFS and MapReduce, Cloud data processing using Pig and Hive, Amazon EMR for creating Hadoop clusters within AWS. Peer to Peer Systems – Napster, Gnutella, FastTrack, BitTorrent, Distributed Hash Tables, IPFS.

Text Book(s)

1. *Andrew S. Tannenbaum and Maarten van Steen, Distributed Systems: Principles and Paradigms, Third Edition, Prentice Hall, 2017.*
2. *Ronald L. Krutz, Russell Dean Vines. Cloud Security: A comprehensive Guide to Secure Cloud Computing, Wiley India 2010.*

Reference(s)

1. *Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011.*
2. *Garg VK, Garg VK. Elements of distributed computing. John Wiley & Sons; 2002.*
3. *George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems: Concepts and Design, Fifth Edition, Pearson Education, 2017.*
4. *Fokkink W. Distributed algorithms: an intuitive approach. Second Edition, MIT Press; 2018.*

24CYS403	WEB APPLICATION SECURITY	L-T-P-C:2-0-3-3

Pre-Requisite(s): 24CYS202 User Interface Design

Course Objectives

- The course will cover the concepts involved in web application development.
- The course will introduce to various vulnerabilities in web applications and their mitigation techniques.

Course Outcome

CO1: Apply client-side web development to design interactive front-end web user interfaces.

CO2: Use server-side web application concepts to develop back-end web server application

CO3: Identify and mitigate various client-side web application security vulnerabilities

CO4: Identify and mitigate various server-side web application security vulnerabilities

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1	3	2						3	1	2
CO2	2	2	3	1	3	2						3	1	2
CO3	3	3	3	3	3	3			3			3	3	3
CO4	3	3	3	3	3	3			3			3	3	3

Syllabus:

Web application development – Introduction - Architecture – Client-side technologies and frameworks – HTML – CSS – Javascript - Ajax/Fetch - Data interchange formats – XML, JSON. Sever-side scripting and technologies - development – technologies - Handling client requests – Database connectivity – Sessions – Cookies.
Web application vulnerabilities – Client-side Vulnerabilities - Cross Site Scripting (XSS) - Cross Site Request Forgery (CSRF) - Cross-origin resource sharing (CORS) - Clickjacking. Server-side Vulnerabilities - SQL injection - OS command injection - Directory traversal - Authentication - Server-side request forgery (SSRF).

Text Books/References:

1. *Robin Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites, Fifth Edition, O'Reilly Media, Inc.; 2018.*
2. *Dafydd Stuttard, and Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Second Edition, John Wiley & Sons; 2011.*

24CYS481	ADVANCED PROTOCOL ENGINEERING AND SECURITY LAB	L-T-P-C:0-0-3-1

Pre-Requisite(s): 24CYS381 Computer Networks Lab and 24CYS281 Operating System Lab

Course Objectives

- This course provides a quick overview of understanding the network topology and its attacks by visualizing it with network simulators.
- It also focusses on exploring network protocols and its attacks in Linux environment.
- Providing a platform to experiment with advanced testbed technologies, and formal verification of protocols.

Course Outcome

CO1: Familiarization of open-source network simulators and its experiments.

CO2: Understanding the protocol dynamics, simulation with active queue management schemes and visualization of attacks.

CO3: Familiarization with Linux Kernel Protocol implementation, kernel modification and recompilation.

CO4: Exploring the formal verification of protocols, network emulation, and testbed technologies.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	3	3								3	3
CO2			3	2	3								3	3
CO3			1	2	3								2	3
CO4			3	3	3								3	3

Syllabus

Experiments with open-source network simulators (NS2 and NS3): Installation and configuration, Creation of network topology and understanding of packet switched network, Simulation and visualization of different types of traffic—congestion controlled and non-congestion controlled, Trace analysis and visualization of protocol dynamics (throughput; packet drop, buffer dynamics, congestion window, round-trip-time, bandwidth delay product, receiver window, etc), Simulation with active queue management schemes, Simulation and visualization of attacks (e.g. IP spoofing and reflection attacks). Socket programming: implementation of IP spoofing and reflection DDoS attacks. Linux Kernel: Familiarization with Linux kernel protocol implementation (TCP/IP) implementation, Tracing and debugging of Linux Kernel TCP/IP source code, Kernel modification and recompilation, Implementation of a non-attack in Linux kernel Network Emulation and testbeds: Network emulation and traffic control using tc (traffic control), dummynet and other advanced tools, Familiarization with advanced testbed technologies (e.g. Emulab, DETER and PlanetLab, etc.), formal verification of protocol: SPIN, UPPAL.

Textbooks:

Issariyakul T, Hossain E. Introduction to network simulator 2 (NS2), Springer, Boston, MA; 2009.

References:

1. *Seth S, Venkatesulu MA. TCP/IP Architecture, Design, and Implementation in Linux. John Wiley & Sons; 2009.*
2. *https://www.emulab.net/portal/frontpage.php*
3. *https://deter-project.org/*
4. *https://planetlab.cs.princeton.edu/*
5. *http://spinroot.com/spin/whatispin.html*
6. *https://uppaal.org/*

24CYS498	PROJECT - PHASE – 1 / SEMINAR	0 0 6 2

Couse Objectives

- First phase of academic project covers problem formulation, study of relevant literature and presentation of findings.
- Gives an opportunity for practical application of computer science in security and help the students to innovate.
- This in turn supports publications, patenting and entrepreneurship

Course Outcomes

CO1: Ability to formulate scientific problem and prepare project execution plan.

CO2: Ability to find and analyse related literature.

CO3: Ability to present, articulate and defend the findings.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3				3	3		2	3	3	3
CO2			3		3			3	3		2	3	3	3
CO3		3	3		3			3	3	3	2	3	3	3

23LAW300	INDIAN CONSTITUTION	L-T-P-C: P/F

Course Objectives

- To know about Indian constitution
- To know about central and state government functionalities in India
- To know about Indian society

Course Outcomes

CO1: Understand the functions of the Indian government
CO2: Understand and abide the rules of the Indian constitution
CO3: Understand and appreciate different culture among the people

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO2	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	2	3	-	-	-	-	-	-

Syllabus

Unit 1
Historical Background – Constituent Assembly Of India – Philosophical Foundations Of The Indian Constitution – Preamble – Fundamental Rights – Directive Principles Of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies For Citizens.

Unit 2
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

Unit 3
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

Text Book(s)
Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.

Reference(s)
Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.

Evaluation Pattern

Assessment	Internal	End Semester
Midterm Exam	20	
*Continuous Assessment (CA)	40	
End Semester/Projects		40

•CA – Can be Quizzes, Assignment, Projects, and Reports

SEMESTER VIII

24CYS499	PROJECT PHASE - 2	L-T-P-C:0 0 30 10

Course Objectives

- Second phase of academic project covers implementation, testing, scientific knowledge dissemination through research articles, and documentation.
- Gives an opportunity for practical application of computer science in security and help the students to innovate.
- This in turn supports scientific/research publications, patenting and entrepreneurship.

Course Outcomes

CO1: Fine-tune the scientific problem and prepare project execution plan

CO2: Design and develop the prototype

CO3: Implement, analyze the findings of the proposed problem

CO4: Present, articulate and defend the solution

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3				3	3		2	3	3	3
CO2			3		3			3	3		2	3	3	3
CO3		3	3		3			3	3	3	2	3	3	3
CO4					3	3		3	3	3	2	3	3	3

PROFESSIONAL ELECTIVE - I

24CYS331	WIRELESS SENSOR NETWORK SECURITY	L-T-P-C:3-0-0-3

Pre-Requisite(s): 24CYS304 - Computer Networks, 24CYS113 - Computer Programming

Course Objectives

- This course introduces the features of Wireless Sensor Networks, their architecture, its protocols, routing, localization and positioning schemes.
- The course also emphasizes on providing an overview of threats in WSN, security primitives to create secure WSN protocols, detection techniques and cryptographic primitives for hardware implementation.

Course Outcomes

CO1: Understand the basic features of Wireless Sensor networks.

CO2: Understand the protocols of Wireless sensor network, its Routing, Localization and Positioning schemes.

CO3: Understand the security attacks, threats and vulnerabilities of WSN.

CO4: Analyze the security frameworks, privacy protection mechanisms and intrusion detection techniques of WSN.

CO5: Understand secure routing, and data aggregation in WSNs.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2	2	2								1	
CO2			3	1	2	2							1	
CO3			3	3	3	2	1					1	2	2
CO4			2	2	2	2						1	3	3
CO5			2	2	1	2	3					1	2	3

Syllabus

Unit 1

Overview of WSN: Introduction, Applications, Unique Constraints and challenges. Sensor Node Hardware: Mica2, TelosB, Cricket, i-Mote2, TMote, BTnode, Wasp mote, comparisons. Sensor Node platforms: TinyOS and Contiki. Network Architecture – Sensor network scenario-Design principles of WSN-Physical layer and

fundamentals of MAC protocols, Low Duty cycle Protocols: SMAC, STEM, Contention Based Protocols: CSMA, PAMAS, Scheduling based Protocols: LEACH, TRAMA.

Unit 2

Routing: Gossiping, Energy efficient unicast, Broadcast and multicast. Localization and Positioning: GPS based localization; Event Driven Localization- Overview of data aggregation. Overview of Wireless Sensor Network Security, Vulnerabilities and Attacks in Wireless Sensor Networks, Symmetric Primitives, Public-Key Primitives, Key Management in Wireless Sensor Networks.

Unit 3

WSN Link-Layer Security Frameworks, Secure Routing in Wireless Sensor Networks, Secure Data Aggregation in Wireless Sensor Networks, Privacy Protection Mechanisms for Sensor Networks, Intrusion Detection Techniques in Sensor Networks, Remote Attestation – Identification, On the Hardware Implementation Efficiency of Cryptographic Primitives.

Text Book(s)

1. *Karl H, Willig A. Protocols and architectures for Wireless Sensor Networks. John Wiley & Sons; 2005.*
2. *Javier Lopez, and Jianying Zhou, Wireless Sensor Network Security, IOS Press; 2008*

Reference(s)

1. *Dargie W, Poellabauer C. Fundamentals of Wireless Sensor Networks: theory and practice. John Wiley & Sons; 2010*
2. *Zhao F, Guibas LJ, Guibas L. Wireless Sensor Networks: an information processing approach. Morgan Kaufmann; 2004*
3. *Anna Hac. Wireless Sensor Networks Designs, John Wiley and Sons; 2004*

24CYS332	MOBILE AND WIRELESS SECURITY	L-T-P-C: 3-0-0-3

Pre-Requisite(s): 24CYS304 - Computer Networks

Course Objectives

- The focus of this course is to enable students to understand the aspects of information and network security that arise in this challenging and ever-evolving space of mobile communication systems.
- The enable students to understand mobile/cellular telephony, and wireless network with physical layer considerations.

Course Outcomes

CO1: Understand relevant aspects of information security in mobile and wireless networks

CO2: Understand the physical layer security mechanisms and protocols in wireless communication

CO3: Understand the authentication and key transport protocol mechanisms used in wireless network security

CO4: Understand security issues and provide solutions for practical wireless systems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2									2	1
CO2	3	3	3	3	2							2	2	1
CO3	3	2		2								2	2	1
CO4	3	3	3	3	2							2	2	1

Syllabus

Unit 1

Fundamentals of Physical layer security – Information theoretic secrecy metrics – channel models - Secret Communication - Coding for Security - Asymptotic Analysis - Key Generation from wireless channels Key agreement techniques.

Unit 2

Secrecy with Feedback - Achieving Secrecy through Discussion and Jamming. MIMO Signal Processing Algorithms for Enhanced Physical Layer Security - Secrecy Performance Metrics.

Unit 3

Physical Layer Security in OFDMA Networks -Power Allocation Law for Secrecy - Multiple Eavesdroppers. Resource Allocation for Physical Layer Security in OFDMA Networks- Application of Cooperative Transmissions to Secrecy Communications - Stochastic Geometry Approaches to Secrecy in Large Wireless Networks.

Text Book(s)

1. *Zhou X, Song L, Zhang Y. Physical layer security in wireless communications.CRC Press; 2013.*

Reference(s)

1. *Chen L, Gong G. Communication system security. Chapman and Hall/CRC; 2012*
2. *Edney J, Arbaugh WA. Real 802.11 security: Wi-Fi protected access and 802.11 i. Addison-Wesley Professional; 2004.*
3. *Chaouchi H, Laurent-Maknavicius M. Wireless and Mobile Networks Security. John Wiley & Sons; 2009.*

24CYS333	INTERNET OF THINGS	L-T-P-C:2-0-3-3

Pre-Requisite(s): 24CYS113 Computer Programming

Course Objectives

- This course covers the fundamentals of IoT and provides skills for IoT based product development.
- The skills students learn in this subject include the selection of sensors, protocols, hardware boards, interfacing, and implementation for product building. Real life case studies are introduced in this course.

Course Outcomes

CO1: Understand the key techniques and theory behind the Internet of Things.

CO2: Apply effectively the various enabling technologies (both hardware and software) for IoT.

CO3: Understand the integration of Cloud and IoT, Edge and Fog Computing.

CO4: Apply various techniques for Data Accumulation, Storage and Analytics.

CO5: Design and build IoT systems for any one interesting Use case.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2								1	1	1
CO2	2	2	2	1	2							2	2	2
CO3	3	3	3	2	2								2	2
CO4	2	2	2	2									2	2
CO5	3	3	3	3	2								3	3

Syllabus

Unit 1

Introduction to IoT - IoT definition - Characteristics - Things in IoT - IoT Complete Architectural Stack - IoT Enabling Technologies - IoT Challenges - IoT Levels - A Case Study to realize the stack. Sensors and Hardware for IoT - Accelerometer, Proximity Sensor, IR sensor, Gas Sensor, Temperature Sensor, Chemical Sensor, Motion Detection Sensor. Hardware Kits - Arduino, Raspberry Pi, Node MCU. Case Study

Unit 2

Protocols for IoT - infrastructure protocol IPV4/V6|RPL), Identification (URLs), Transport (WiFi, LiFi, BLE), Discovery, Data Protocols, Device Management Protocols. - A Case Study with MQTT/CoAP usage. Cloud and Data analytics- Types of Cloud - IoT with cloud challenges - Selection of cloud for IoT applications - Fog

computing for IoT - Edge computing for IoT - Cloud security aspects for IoT applications - RFM for Data Analytics - Case Study with AWS / AZURE / Adafruit / IBM Bluemix.

Unit 3

Case studies with architectural analysis: IoT applications - Smart City - Smart Water - Smart Agriculture - Smart Energy - Smart Healthcare - Smart Transportation - Smart Retail - Smart Waste Management.

Text Book

1. *Bahga A, Madisetti V. Internet of Things: A Hands-on Approach; 2014.*

Reference(s)

1. *Shriram K Vasudevan, Abhishek SN and Sundaram RMD. Internet of Things, First Edition, Wiley India;2019.*
2. *Raj P, Raman AC. The Internet of things: Enabling Technologies, Platforms, and Use-cases. Auerbach Publications; 2017.*
3. *Adrian McEwen. Designing the Internet of Things, Wiley;2013.*

PROFESSIONAL ELECTIVE-2

24CYS334	PROGRAM OBFUSCATION	L-T-P-C:3-0-0-3

Pre-requisite: 24CYS212 - Multimedia Processing & 24CYS302 Secure Coding

Course Objectives

- To understand Obfuscation algorithms, application of code obfuscation techniques along with tamper proofing and watermarking.
- To provide understanding of program analysis using static and dynamic approach and familiarize with some of the reverse engineering tools.
- To explain various software similarity measures and a brief focus on data hiding techniques

Course Outcome

CO1: Study different methods of obfuscating code and various application of code obfuscation, watermarking, tamper proofing.

CO2: Understand program analysis using static and dynamic analysis and familiarize with reverse engineering tools

CO3: Can identify different software watermarking methods and how to resist attacks.

CO4: Apply software similarity analysis for testing purpose and also understand some of the hiding techniques in different media

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	1	2	3	3	3	3					3	3
CO2	2	3	1	2	3	3	1	2					3	3
CO3		1	2	2	3	3	3	3					3	3
CO4		1		1	3	3	1	2			2		1	3

Syllabus

Unit 1:

Introduction to Program Obfuscation – applications of code obfuscation, tamper proofing, software watermarking, software similarity. Methods of attack and defense – attack and defense strategies. Program analysis- static and dynamic analysis. reverse engineering tools. Code obfuscation- Complicating control flow, Opaque predicates, Data encoding, Breaking abstractions.

Unit 2:

Dynamic Obfuscation, Software tamper proofing – checking for tampering, responding mechanisms, remote tamper proofing. Software watermarking – different methods and its applications, tamper proofing watermarks, improving resilience and stealth, dynamic watermarking methods-by exploiting aliasing, parallelism, and expanding execution paths.

Unit 3:

Software similarity analysis- k-gram based analysis, API based analysis, tree and graph-based analysis, metrics-based analysis. Basics on hardware for protecting software.

Case Study: Data hiding in digital Audio and Video, Operating System Data Hiding, Virtual Data Hiding, Data Hiding in Network Protocols, Data Hiding among Android Mobile Devices and Apple iOS, Forensics and Anti-Forensics, Mitigation Strategies.

Text Book(s):

1. *C. Collberg and J. Nagra, Surreptitious Software: Obfuscation, Watermarking, and Tamperproofing for Software Protection, Addison-Wesley; 2010*
2. *M. T. Raggo and C. Hosmer, Data Hiding: Exposing Concealed Data in Multimedia, Operating Systems, Mobile Devices and Network Protocols, 1st Edition, Syngress; 2012*

24CYS335	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	L-T-P-C:3-0-0-3

Pre-Requisite: 24CYS304 Computer Networks & 24CYS302 Secure Coding

Course Objectives

- Understand the legal aspects, industry ethics and the approaches and methodologies used when performing a penetration test.
- Be able to use the appropriate penetration testing tools for a given scenario and understand their output.
- Discuss implications of common vulnerabilities and recommend ways to rectify or mitigate them.

Course Outcome

CO1: To gain knowledge about vulnerability assessment and penetration testing.

CO2: To learn about various types of attacks, attackers and security threats and vulnerabilities present in the computer system.

CO3: To examine how social engineering can be done by attacker to gain access of useful & sensitive information about the confidential data.

CO4: To gain knowledge of the tools, techniques and ethical issues likely to face the domain of ethical hacking and VAPT.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1						3					3	
CO2	2	2			2								2	
CO3			2	1	1	3		1					2	2
CO4	2	1	3	2	2									3

Syllabus

Unit 1

Introduction to vulnerability assessment, Foot printing & Social engineering Information gathering methodologies- Competitive Intelligence- DNS Enumerations- Social Engineering attacks. Scanning & Enumeration Port Scanning-Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting Enumeration. System Hacking Password cracking techniques- Key loggers- Escalating privileges.

Unit 2

Sniffers & SQL Injection Active and passive sniffing- ARP Poisoning- Session Hijacking- DNS Spoofing- Conduct SQL Injection attack - Countermeasures. Introduction to Metasploit: Metasploit framework, Metasploit Console, Payloads, Meterpreter, Introduction to Armitage, Installing and using Kali Linux Distribution, Introduction to penetration testing tools in Kali Linux. Case Studies of recent vulnerabilities and attacks.

Unit 3

Introduction to Reverse Engineering of Android Apps- Introduction to Android OS and App Development - Architecture, Types of Applications, Building an App, Understanding Activities, Activity Lifecycle, Managing State. Understanding various layouts and UI controls, Introduction to Android OS Security, Static and Dynamic Analysis of Android Apps, Native Library Exploitation, OWASP Top ten mobile vulnerabilities, Security Assessment with Drozer, Burp suite, Some of the attacks and Vulnerabilities in real world android apps: A case study. Hybrid Mobile Application Development and its security.

Textbooks:

1. *Kimberly Graves, CEH: Official Certified Ethical Hacker Review Guide, Wiley Publishing Inc.; 2007*
2. *Shakeel Ali and Tedi Heriyanto, Backtrack -4: Assuring security by penetration testing", PACKT Publishing; 2011*
3. *Baloch, R., Ethical Hacking and Penetration Testing Guide, CRC Press; 2015*

24CYS336	BLOCKCHAIN TECHNOLOGY	L-T-P-C:2-0-3-3

Prerequisite(s): Nil

Course Objectives

- To provide an understanding of Decentralized blockchain-based systems, such as Bitcoin and Ethereum, and its position in the present technological landscape.
- To understand the impact and role of Blockchain Technology in financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts

Course Outcome

CO1: Understand the basic principles of Distributed Ledger Technology

CO2: Able to demonstrate the cryptographic primitives in Blockchain technology

CO3: Understand and evaluate various consensus protocols

CO4: Develop Smart Contracts and create a DApp using Ethereum Blockchain

CO5: Analyze a real-world use case and provide how blockchain could be used to address the challenges faced

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2									2	2
CO2	3	3	3	3	3								3	3
CO3	2	3	3	3									2	2
CO4	3	2	3	3	2								2	3
CO5	3	3	3	3	2							2	3	3

Syllabus

Blockchain Data Structure – Hash Chain - Distributed Database - Blockchain Architecture - Terminologies in Blockchain: Hashes - Transactions - Addresses - Wallet - Private Key Storage - Ledgers - Blocks - Chaining Blocks; Consensus and multiparty agreements: Proof of Work (PoW) - Proof of Stake (PoS) - Delegated Proof of Stake (DPoS) - Proof of Elapsed Time (PoET) - Proof of Importance - Reputation-based mechanisms - Practical Byzantine Fault Tolerance (PBFT); Blockchain Platforms: Cryptocurrencies (Bitcoin, Litecoin, Ethereum) - Hyperledger - Ethereum; Blockchain implementation; Smart Contract - Web3.js - MetaMask; Forking; Soft Fork - Hard Fork - Cryptographic Changes and Forks; Blockchain as a Service - IPFS and Blockchain - Challenges in Blockchain; Concurrency, Scalability and Privacy.

Text Book(s)

1. *Imran Bashir, Mastering Blockchain; 2017.*

2. *Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton Univ Press; 2016*
3. *Alex Leverington, Ethereum Programming, Packt Publishing Limited; 2017.*

Reference(s)

1. *Andreas M. Antonopoulos, Mastering Bitcoin - Programming the Open Blockchain, O'Reilly Media, Inc.; 2017*
2. *Draft NISTIR 8202, Blockchain Technology Overview - NIST CSRC; 2018.*
3. *Roger Wattenhofer, CreateSpace, The Science of the Blockchain, Independent Publishing Platform; 2016*

PROFESSIONAL ELECTIVE - 3

24CYS337	FORMAL METHODS FOR SECURITY	L-T-P-C:3-0-0-3

Prerequisite: 24MAT118: Discrete Mathematics

Course Objectives

- To provide basic understanding and fundamentals of Formal Methods and its role in Security.
- To discuss various methods for Logic and Program Verification.
- To demonstrate different tools available to perform analysis and detect security vulnerabilities.

Course Outcome

CO1: Introduction to Formal Methods - Logic and Program Verification.

CO2: Understand Temporal Logic and Model Checking for program verifications.

CO3: Verification of concurrent and reactive programs/systems using model-checking and propositional temporal logic.

CO4: Application of static and dynamic program analysis and model checking for detecting common security vulnerabilities in programs and communication protocols

CO5: Familiarizing SPIN, PVS, TAMARIN, Frama-C and Isabelle tools.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2									2	2
CO2	2	2	2	2	2								2	2
CO3	2	3	2	3	2								3	3
CO4	3	3	3	3	3								3	3
CO5	2	2	2	2	3								2	3

Syllabus

Formal Methods – Definition - Need for Formal Methods - Propositional and Predicate Logic, and theorem-proving, Fixed-points and their role in program analysis and model-checking, Verification of sequential programs using weakest preconditions and inductive methods, and verification of concurrent and reactive programs/systems using model-checking and propositional temporal logic (CTL and LTL), Application of static and dynamic program analysis and model-checking for detecting common security vulnerabilities in programs and communication protocols, Information flow and taint analysis for security of web applications, SPIN, PVS, TAMARIN, Frama-C and Isabelle tools.

Text Book(s)

1. *Veith, Helmut, et al. Model Checking. United Kingdom, MIT Press; 2018.*
2. *G. Bella, Formal Correctness of Security Protocols, Springer; 2009.*
3. *Datta A, Jha S, Li N, Melski D and Reps T, Analysis Techniques for Information Security, Synthesis Lectures on Information Security, Privacy, and Trust; 2010.*

Reference(s)

1. *Lloyd, J.W., Logic and Learning: Knowledge Representation, Computation and Learning in Higher-order Logic, Springer Berlin Heidelberg; 2003.*
2. *M. Ruth and M. Ryan, Logic in Computer Science - Modelling and Reasoning about Systems, Cambridge University Press; 2004.*

24CYS338	HARDWARE SECURITY	L-T-P-C:3-0-0-3

Pre-Requisite(s): Nil

Course Objectives

- To develop crypto algorithms on hardware platform by enabling security features.
- Familiarize with different side channel attacks and its preventive techniques.
- Understanding the fault-tolerance and verification of cryptographic hardware.

Course Outcomes

CO1: Able to develop crypto algorithms and incorporate security features on FPGA.

CO2: Identify side channel attack and its prevention techniques.

CO3: Able to understand different approaches for hardware Trojan and Piracy detection and analysis.

CO4: Evaluation and verifying of cryptographic Hardware.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	3		1	1	2	2		2	3	3	
CO2		3	3	3		1	2	2	2		2	3	3	
CO3		3	3	3		1	3	2	2		2	3	3	3
CO4		3		3		3	3	2	2		2	3	3	3

Syllabus

Unit 1

Development of crypto algorithms and other security features on to hardware platform, standards of security – FIPS, 140-2 level 3. Overview of different issues of hardware security - Basics of Digital Design on Field-programmable Gate Array (FPGA), Optimization of Cryptographic Hardware on FPGA, Physically Unclonable Functions (PUFs), PUF Implementations, PUF Quality Evaluation, Design Techniques to Increase PUF Response Quality.

Unit 2

Side-channel Attacks on Cryptographic Hardware: Current-measurement based Side channel Attacks (Case Study: Kocher's Attack on DES), Design Techniques to Prevent Side channel Attacks, Improved Side-channel Attack Algorithms (Template Attack, etc.), Cache Attacks.

Unit 3

Testability and Verification of Cryptographic Hardware: Fault-tolerance of Cryptographic Hardware, Fault Attacks, Verification of Finite-field Arithmetic Circuits Hardware Trojans: Hardware Trojan Nomenclature and Operating Modes, Countermeasures such as Design and Manufacturing Techniques to Prevent/Detect Hardware Trojans, Logic Testing and Side-channel Analysis based techniques for Trojan Detection

Textbooks:

1. *Debdeep Mukhopadhyay and Rajat Subhra Chakraborty, Hardware Security: Design, Threats, and Safeguards, CRC Press; 2014*
2. *Bhunia, Swarup, and Mark Tehranipoor. Hardware security: a hands-on learning approach. Morgan Kaufmann; 2018*

References:

1. *Sadeghi, Ahmad-Reza, and David Naccache. Towards hardware-intrinsic security. Springer Berlin Heidelberg; 2010.*
2. *Huffmire, Ted, Cynthia Irvine, Thuy D. Nguyen, Timothy Levin, Ryan Kastner, and Timothy Sherwood. Handbook of FPGA design security. Springer Science & Business Media; 2010.*
3. *Mangard, Stefan, Elisabeth Oswald, and Thomas Popp. Power analysis attacks: Revealing the secrets of smart cards. Springer Science & Business Media; 2008*
4. *Tehranipoor, Mohammad, and Cliff Wang, eds. Introduction to hardware security and trust. Springer Science & Business Media; 2011.*

24CYS339	**BIOMETRICS AND SECURITY**	**L-T-P-C:3-0-0-3**

Pre-Requisite: 24CYS212 Multimedia Processing

Course Objectives

- Understand the technological uplifts with biometrics compared to traditional securing mechanisms and standards applied to security
- To understand the concepts of different types of biometrics and to enable design of biometric system and its privacy risks
- To familiarize with biometric interface and biometric applications

Course Outcome

CO1: Apply biometric matching to identify algorithms for finger biometric technology, check the performance measures and its security

CO2: Develop facial biometric, iris biometric, voice biometric, physiological biometrics for identification technology.

CO3: Understand different types of user interfaces.

CO4: Designing privacy sympathetic biometric systems and identifying the area of biometric applications

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	2	3		3					3	3
CO2	2	3	3	2	2	3		3					3	3
CO3		3	3	1	2	3		2					2	2
CO4	2	3	3	3	2	3		3					3	3

Syllabus

Biometric Fundamentals and Standards: Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification -Identification -Biometric matching, Performance measures in biometric systems, Assessing the privacy risks of biometrics -Designing privacy sympathetic biometric systems, Different biometric standards, Application properties.
Physiological Biometrics: Facial scan, Ear scan, Retina scan, Iris scan, Finger scan, Automated fingerprint identification system, Palm print, Hand vascular geometry analysis, Knuckle, DNA, Dental, Cognitive Biometrics -ECG, EEG.
Behavioral Biometrics: Signature scan, Keystroke scan, Voice scan, Gait recognition, Gesture recognition, Video face, Mapping the body technology.
User interfaces: Biometric interfaces: Human machine interface -BHMI structure, Human side interface: Iris image interface -Hand geometry and fingerprint sensor, Machine side interface: Parallel port -Serial port -Network topologies, Case study: Palm Scanner interface.
Biometric applications: Categorizing biometric applications, Application areas: Criminal and citizen identification –Surveillance -PC/network access -E-commerce and retail/ATM, Costs to deploy, Issues in deployment, Biometrics in medicine, cancellable biometrics.

Text Books/References:

1. *Anil K Jain, Patrick Flynn and Arun A Ross, Handbook of Biometrics, Springer, US; 2010*
2. *John R Vacca, Biometric Technologies and Verification Systems, Elsevier, USA; 2009*
3. *Samir Nanavati, Michael Thieme and Raj Nanavati, Biometrics –Identity Verification in a Networked World, John Wiley and Sons ; 2003*
4. *Paul Reid, Biometrics for Network Security, Pearson Education; 2004*
5. *ReidM. Bolle et al, Guide to Biometrics, Springer, USA; 2004*
6. *David D Zhang, Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers; 2000.*

24CYS340	QUANTUM CRYPTOGRAPHY	L-T-P-C:3-0-0-3

Pre-Requisite: 24CYS206 Modern Cryptography 24CYS314 Applied Cryptography

Course Objectives

- To provide students with a comprehensive understanding of quantum cryptography and post-quantum cryptographic algorithms, particularly those based on lattice problems.
- Gain practical skills in implementing and analyzing these algorithms using modern computational tools.
- To equip students with the knowledge required to address current and future security challenges posed by quantum computing.

Course Outcome

CO1: Understand and comprehend quantum cryptography principles

CO2: Grasp Post-Quantum Cryptographic Algorithms

CO3: Learn the standard CRYSTALS-Kyber and CRYSTALS-Dilithium

CO4: Apply Number Theoretic Transforms and Solve Advanced Lattice Problems

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2								2	
CO2		3		3									3	2
CO3	2	2	2	1									3	2
CO4	2	2	2	1									3	2

Syllabus

Unit 1

Introduction to Qubits, Quantum Entanglement, Bell's Inequality, Density matrices, Measurements, Quantum algorithms, No cloning theorem, Quantum Key Distribution, BB84 protocol, E91 protocol, privacy amplification, randomness extractor.

Unit 2

Properties of Lattices, Worst case to Average case reduction, Cryptographic hard problems, LWE, SIS problems, Ring and module Variants.

Unit 3

Key encapsulation mechanisms, Number Theoretic Transforms, CRYSTALS-Kyber, CRYSTALS-Dilithium.

Text Books/References:

1. *Micciancio, Daniele, and Oded Regev. "Worst-case to average-case reductions based on Gaussian measures." SIAM Journal on Computing 37.1 (2007): 267-302.*
2. *Peikert, Chris. "A decade of lattice cryptography." Foundations and trends® in theoretical computer science 10.4 (2016): 283-424.*
3. *Bernstein, D. J., Buchmann, J., & Dahmen, E. (2009). Post-Quantum Cryptography.*
4. *Micciancio, D., & Regev, O. (2009). Lattice-based cryptography.*
5. *Micciancio, D., & Peikert, C. (2012). Trapdoors for Lattices: Simpler, Tighter, Faster, Smaller.*
6. *Schönhage, A. (1982). Fast algorithms for number-theoretic transforms.*
7. *Lenstra, Arjen K., Hendrik Willem Lenstra, and László Lovász. "Factoring polynomials with rational coefficients." Mathematische annalen 261 (1982): 515-534.*
8. *Shor, Peter W. "Algorithms for quantum computation: discrete logarithms and factoring." Proceedings 35th annual symposium on foundations of computer science. Ieee, 1994.*
9. *Dilithium official repository and documentation.*
10. *Kyber official repository and documentation.*

24CYS341	CYBER ANALYTICS	L-T-P-C:3-0-0-3

Pre-Requisite: NIL

Course Objectives

- To introduce students to the fundamental concepts and methodologies of cyber analytics
- To understand and apply frameworks like MITRE ATT&CK, MITRE Shield, and MITRE CAR
- To develop skills in data collection, analysis, and threat detection using cyber analytics tools
- To equip students with the knowledge required to address current and future security challenges posed by quantum computing.

Course Outcome

CO1: To gain knowledge about fundamental concepts related to process of cyber analytics in the cybersecurity domain
CO2: To understand and apply frameworks like MITRE ATT&CK, MITRE Shield, and MITRE CAR
CO3: To develop skills in data collection, analysis, and threat detection using cyber analytics tools
CO4: To apply cyber analytics skill for threat detection, threat prevention, incident response, forensic analysis and risk detection.
CO5: To interpret and analyze information and to organize ideas in a logical and coherent manner.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												2	
CO2	1				2								3	2
CO3				1	2								3	3
CO4					2								2	2
CO5		1								2			2	

Syllabus

Unit 1

Introduction to Cyber Analytics - Overview and significance of cyber analytics - Key concepts, terminologies, and metrics used in cyber analytics.

Unit 2

MITRE ATT&CK Framework - In-depth understanding of Tactics, Techniques, and Procedures (TTPs) - Mapping and analyzing cyber threats using the ATT&CK framework - Practical applications and case studies.

Unit 3

MITRE Shield Framework - Principles of active defense and deception in cybersecurity - Implementing MITRE Shield strategies in real-world scenarios - Integration of Shield with ATT&CK for comprehensive defense mechanisms.

Unit 4

MITRE Cyber Analytics Repository (CAR) - Introduction to the MITRE CAR framework - Developing and engineering detection analytics - Hands-on exercises and labs using CAR data sets.

Unit 5

Advanced Cyber Analytics Techniques - Advanced data collection and preprocessing techniques - Machine learning applications in cyber analytics - Predictive analytics, anomaly detection, and their practical implementation.

Text Books/References:

1. *Vandana P Janeja, Data Analytics for Cybersecurity. Cambridge University Press, 2022.*
2. *The CAR Guide to Cyber Analytics, MITRE Corporation. https://car.mitre.org/*
3. *MITRE ATT&CK Framework for Threat Detection. https://attack.mitre.org/*
4. *MITRE Shield Framework, MITRE Corporation. https://shield.mitre.org/resources/downloads/Introduction_to_MITRE_Shield.pdf*
5. *MITRE ENGAGE. https://engage.mitre.org/*
6. *MITRE DEFEND. https://d3fend.mitre.org/*
7. *NIST Special Publication 800-86: Guide to Integrating Forensic Techniques into Incident Response. https://csrc.nist.gov/pubs/sp/800/86/final*
8. *David Stuart. Practical Data Science for Information Professionals. Facet Publishing, 2020. https://www.cambridge.org/core/books/practical-data-science-for-information-professionals/7286D504BEA81B1367EF67B71698182F*
9. *Knapp ED, Samani R. Applied cyber security and the smart grid: implementing security controls into the modern power infrastructure. Newnes; 2013 Feb 26. https://www.sciencedirect.com/book/9781597499989/applied-cyber-security-and-the-smart-grid*

24CYS342	ZERO-TRUST ARCHITECTURE	L-T-P-C:3-0-0-3

Pre-Requisite: NIL

Course Objectives

- To provide a comprehensive understanding of Zero-Trust Architecture (ZTA).
- To teach principles and implementation strategies of ZTA in various environments.
- To design and deploy zero-trust solutions in enterprise and industrial environments.

Course Outcome

CO1: Understand and comprehend Zero-Trust Architecture (ZTA).

CO2: To gain knowledge about principles and implementation strategies of ZTA in various environments

CO3: To design and deploy zero-trust solutions in enterprise and industrial environments.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												2	
CO2	1				2								3	2
CO3	1		3		2								3	3

Syllabus

Unit 1: Introduction to Zero Trust Architecture

Overview of zero trust principles - Importance and benefits of ZTA in modern cybersecurity

Unit 2: Components of Zero Trust Architecture

Core components: identity, devices, networks, applications, and data - Implementing zero trust in identity and access management

Unit 3: Implementing Zero Trust

Designing and engineering a zero trust network - Implementing zero trust access policies - Case studies on successful zero trust implementations.

Unit 4: Zero Trust in Cloud Environments

Cloud security challenges and engineering solutions - Applying zero trust principles to cloud infrastructure.

Unit 5: Advanced Topics in Zero Trust

Zero trust for remote workforces - Implementing zero trust in operational technology (OT) environments - Future trends and engineering advancements in zero trust architecture

Text Books/References:

1. *Cindy Green-Ortiz, Brandon Fowler, David Houck, Hank Hensel, Patrick Lloyd, Andrew McDonald, Jason Frazier. Zero Trust Architecture. Cisco Press. 2024.*
2. *Razi Rais, Christina Morillo, Evan Gilman, Doug Barth. Zero Trust Networks: Building Secure Systems in Untrusted Networks. O'Reilly Media, Incorporated, 2024.*
3. *Zero Trust Enterprise infrastructure, Dzone Magazine, Oct 2023.*
   https://dzone.com/articles/zero-trust-architecture-enterprise-infrastructure-1

ELECTIVES IN BUSINESS SYSTEMS/MANAGEMENT ELECTIVE

24CYS431	SOFTWARE PROJECT MANAGEMENT	L-T-P-C:3-0-0-3

Pre-requisite: Nil

Course Objectives

- This course describes the key aspects of a software project.
- It introduces the basic principles of Engineering Software Projects. Most, if not all, students' complete projects as part of assignments in various courses undertaken. These projects range in size, subject and complexity but there are basic project essentials that need to be understood and practiced for successful team project outcomes.
- The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development.

Course Outcomes

CO1: To understand the basic concepts, terminologies and issues of software project management.
CO2: To apply appropriate methods and models for the development of solutions.
CO3: To analyze the cost-benefits of calculations so as to optimize the selection strategy.
CO4: To evaluate methods, models and technologies towards achieving project success.
CO5: To design and evaluate network planning models with criticality.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1								1		3	2
CO2	3	2	3						3	3		2	3	2
CO3	3	2	2	3	2	2	2	2	3	3	2	2	3	2
CO4	2	2	2	1	3	2	2	2	3	3		2	3	2
CO5	3	2	3	3	3	2	2	2	3	3		2	3	2

Syllabus

Unit 1

Introduction to Software Project Management- Software Projects - ways of categorizing software projects – problems with software projects - Project Life Cycle– Management -Setting objectives –Stakeholders - Project Team- Step-wise : An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.

Unit 2

Activity planning-- project schedules - sequencing and scheduling projects - Network planning model – AON and AOA-identifying critical activities-Crashing And Fast Tracking-,Risk management—Categories , Risk planning, Management and Control - Evaluating risks to the schedule. PERT- Resource Allocation, Monitoring and Tracking - Monitoring and control - allocation - identifying resource requirements - scheduling resources - creating critical paths - publishing schedule - cost schedules- sequence schedule.

Unit 3

Monitoring and control – Visualizing Progress, earned value analysis, managing people and organizing teams-organizational structures- Planning for small projects. Case Study: PMBOK, Agile Development

Text Book

Mike Cotterell, Bob Hughes. Software Project Management, Fifth Edition, Tata McGraw-Hill; 2012.

Reference(s)

1. *Roger S. Pressman. Software Engineering – A Practioner's Approach, Eighth Edition, Tata McGraw-Hill publishers; 2014.*
2. *Jalote P. Software Project Management in practice, Second edition, Person Education; 2003.*

24CYS432	FINANCIAL ENGINEERING	L-T-P-C:3-0-0-3

Pre-Requisite(s): Nil

Course Objectives

- This course serves as an introduction to financial engineering including cash flows, financial decision making etc.
- It gives a thorough yet highly accessible mathematical coverage of standard and recent topics of introductory investments: fixed-income securities, modern portfolio theory, optimal portfolio growth and valuation of multi-period risky investments.

Course Outcomes

CO1: Apply basic concepts to understand and evaluate cash flows.

CO2: Evaluate and arrive at a financial investment decision employing the underlying knowledge of stocks and derivatives.

CO3: Analyse and design Portfolio selection methods.

CO4: Understand capital market theory for stock performance evaluation

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			2								3	2
CO2	2	3	1										3	2
CO3	1	3			2								3	2
CO4	2	1											3	2

Syllabus

Unit 1

Cash Flows and Fixed income securities: Investments and markets - Principal and interest - Present and future values of streams - IRR. Fixed income securities - Market value for future cash - Bond value - Bond details – Yields – Convexity – Duration - Immunization. Bond portfolio management - Level of market interest rates, Term structure of interest-rate theories.

Unit 2

Stocks and Derivatives: Common stock valuation - Present value of cash dividends - Earnings approach - Value versus price - Efficient markets theory - Technical analysis. Analysis of financial statements. Derivatives - futures and options - Black Scholes formula - Utility functions - Applications in financial decision making.

Unit 3

Portfolio analysis and capital market theory: Covariance of returns – Correlation - Portfolio return - Portfolio standard deviation - Two asset case - Efficient frontier - Optimum portfolio. Capital market theory - Capital market line - Sample diversifications to reduce risk - Characteristic line - Capital asset pricing model. Arbitrage price theory - Stock performance evaluation.

Text Book(s)

1. *David Luenberger, Investment Science. Second Edition, Oxford University Press; 2013*
2. *Jack Clark Francis, Richard W. Taylor. Investments, Schaum's Outlines, Tata McGraw Hill ;2006.*

Reference(s)

1. *Lyuu YD. Financial Engineering and Computation. Cambridge University Press; 2004.*
2. *Perry H. Beaumont. Financial Engineering Principles. John Wiley and Sons Inc, New Jersey; 2004.*

24MNG431	FINANCIAL MANAGEMENT	L-T-P-C:3-0-0-3

Course Objectives

- The course would prepare engineering students to understand the overview of financial management; inculcate methods and concepts on valuation and familiarize with working capital management, financial analysis and planning.

Course Outcomes

CO1: Understand the overview of financial management.

CO2: Apply methods and concepts on valuation.

CO3: Understand with working capital management, financial analysis and planning.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3					1	1		3	3	3	2
CO2	2	3	3					2	1		3	3	3	2
CO3	2	3	2					1	1		3	3	3	2

Syllabus

Unit 1

Introduction: Financial Management an overview – Financial Decisions in a firm – Goal of FM – Function of the financial system.

Unit 2

Fundamental Valuation Concepts: Time value of money – Risk and Return. Capital Budgeting: Techniques of capital budgeting investment criteria– NPV – Benefit Cost Ratio – IRR – Payback Period – ARR – Investment appraisal in Practice – Estimation of Project cost flows.

Unit 3

Working Capital Management: Current Assets – Financing Ruling – Profit Criterion. Cash and Liquidity Management. Working Capital Financing, Financial Analysis and Planning**:** financial instruments, sources of long-term, intermediate term and short-term finance. Analyzing Financial Performance – Break – even analysis and Leverages – Financial Planning and Budgeting, Mergers and Takeovers- International trade.

Text Book(s)

1. *Chandra, P. Financial Management: Theory and Practice, Ninth Edition, TMH; 2017.*

2. *Denzil Watson, Antony Head. Corporate Finance- Principles and Practice, Second Edition, Pearson Education Asia; 2016.*
3. *R L Varshney, K L. Maheshwari. Managerial Economics, S Chand & Sons; 2014.*

Reference(s)

1. *Stephen Blyth. An Introduction to Corporate Finance, McGraw Hill Book Company; 2014.*
2. *Brigham EF, Ehrhardt MC, Nason RR, Gessaroli J. Financial Management: Theory &Practice, Canadian Edition. Nelson Education; 2016.*

24MNG432 INFORMATION SECURITY RISK MANAGEMENT L-T-P-C:3-0-0-3

Course Objectives

- Understand context of information security management, Identify and value information assets
- Identify and prioritize threats to information assets
- Define an information security strategy and architecture
- Understand the risk management surrounding information systems and learn how security and management are interrelated

Course Outcome

CO1: Able to identify threats and vulnerabilities to Information Systems.

CO2: Understand risk management, risk analysis and how to mitigate risks.

CO3: Able to perform testing and vulnerability assessment.

CO4: Able to manage information security and evaluate and design information architecture using secure coding practices.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	2	3	1					3		1	3	3
CO2		3	2	3	1					3		1	3	
CO3		3	2	3	3					3	3	2	3	3
CO4		3	3	3	3					3	3	2	3	3

Syllabus

Unit 1

Management systems, Context of information security management system, Security Governance and Management, Threats to Information Systems, Threat categorization, Vulnerability categorization, Information technology and security basics, Concept of IT security, Need for securing IT resources, Policy framework on IT assets security, Management of IT security, Importance of training, Business Process Outsourcing, Applications of e-business issues and trends, Concepts of risk management- Risk based planning of Information Systems, Risk management of Information Systems, Why Risk Assessment, and When Risk Assessment to be conducted. Information Security Risk Analysis, Approaches to risk analysis / assessment, Risk Assessment, Risk Mitigation, Effectiveness Evaluation, Risk due to Social Engineering, Cost Benefit Analysis.

Unit 2

Disaster Recovery & Business Continuity Management, Business impact analysis, Business Continuity and DR Plan development, Exercising, Maintenance and revision of plan, importance of training, Objectives and methods for risk assessment, Natural disaster, Technological hazards and terrorist threats, implications for emergency response, Vulnerability of critical infrastructures. Privacy Management, Privacy regulations and laws, GDPR, HIPAA and PDPA

Unit 3

Managing Information Security, Organization and responsibilities, Information Security Governance, Security Incident Management, Application Security, Data and information Analyze, evaluate and design information architecture, Role of databases and database management systems, Knowledge management systems and data warehouses, Secure Coding Practices, ISO 27001 - Domains, Introduction to SOX, HIPAA, CoBlT.

Textbooks:

1. *Kairab, Sudhanshu. A practical guide to security assessments. CRC Press; 2004*
2. *Harold F. Tipton and Micki Krause, Information Security Management Handbook, Fifth Edition, CRC Press; 2004*

References:

1. *Kevin Lam, David LeBlanc and Ben Smith, Assessing Network Security, Microsoft Press; 2004*
2. *Simson Garfinkel, Web Security, Privacy & Commerce, Second Edition O'Rely, Computer networks / Security measures; 2002*
3. *Thomas R. Peltier, Information Security Risk Analysis, CRC Press; 2001*
4. *Whitman, M. and Mattord, H., Principles of Information Security, Second Edition, Boston: Thomson Course Technology; 2005*

FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS COMMON TO ALL PROGRAMS

23CUL230	**ACHIEVING EXCELLENCE IN LIFE -AN INDIAN PERSPECTIVE**	**L-T-P-C: 2-0-0-2**

Course Objectives:

The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

Syllabus

Unit 1

Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;
Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (workshop); Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2

Personality Development
What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;
Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge; Communication Skills - An Indian Perspective;

Unit 3

Developing Positive Attitude & Friendliness - (Vedic Perspective);
Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);
Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:

1. *Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9*
2. *Complete works of Swami Vivekananda (Volumes 1 to 9)*
3. *Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)*
4. *Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)*
5. *Message of Upanishads, by Swami Ranaganathananda published by Bharatiya Vidya Bhavan, Bombay.*

6. *Personality Development – Swami Vivekananda published by Advaitha Ashram, Kolkatta.*
7. *Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay*
8. *Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkatta*
9. *Ultimate Success - Swami Ramakrishnananada Puri published by Mata Amritanandamayi Math, Kollam*
10. *Yoga In Daily Life - Swami Sivananda – published by Divine Life Society*
11. *Hindu Dharma - H. H. Sri Chandrasekharandra Saraswati published by Bharatiya Vidya Bhavan, Bombay*
12. *All about Hinduism – Swami Sivananda - Published by Divine Life Society*
13. *The Mind and its Control by Swami Budhananda published by Advaitha Ashram, Kolkatta*
14. *Krida Yoga - Vivekananda Kendra, Publication.*
15. *Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi*
16. *New perspectives in Stress Management - Dr H R Nagendra & Dr R Nagaratna published by Swami Vivekananda Yoga Prakashana, Bangalore.*
17. *Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.*
18. *Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CUL231	EXCELLENCE IN DAILY LIFE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

1. The anatomy of 'Excellence'. What is 'excellence'? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.
3. To work towards excellence, one must know where he is. Our present state... An introspective analysis. Our faculties within.

Unit 2

4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensible role of the intellect. How to achieve and apply clear thinking?
6. The quagmire of thought. The doctrine of Karma – Law of Deservance.
7. Increase Productivity, reduce stress, work patterning.

Unit 3

8. The art of right contact with the world. assessment, expectations.
9. Myths and Realities on key issues like richness, wisdom, spirituality.
10. Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:

The Bhaja Govindam and the Bhagavad Gita.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CUL232	EXPLORING SCIENCE AND TECHNOLOGY IN ANCIENT INDIA	L-T-P-C: 2-0-0-2

OBJECTIVES:

This course offers a journey of exploration through the early developments in India of astronomy, mathematics,technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as well as actual techniques.

Syllabus

Unit 1

1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2

1. Astronomy & mathematics in Jain and Buddhist literature;
2. The transition to the Siddhantic period; Aryabhata and his time;
3. The Aryabhatiya: concepts, content, commentaries;
4. Brahmagupta and his advances;
5. Other great Siddhantic savants;
6. Bhaskara II and his advances;

Unit 3

1. The Kerala school of mathematics;
2. The Kerala school of astronomy;
3. Did Indian science die out?;
4. Overview of recent Indian scientists, from S. Ramanujan onward;
5. Conclusion: assessment and discussion;

TEXTBOOK:

Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao

REFERENCE:

IFIH's interactive multimedia DVD on Science & Technology in Ancient India.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CUL233	YOGA PSYCHOLOGY	L-T-P-C: 2-0-0-2

OBJECTIVES:

This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. Thecourse includes experiential components centering on meditation and spiritual practice.

Syllabus

Unit 1

Introduction to Modern Psychology
A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in WesternPsychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology
What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of allYoga-schools.

Patanjali Yoga Sutra – 1
Introduction to Rishi Patanjali - Bird view of Yoga-Sutra - Definition of Yoga – Vrittis.

Patanjali Yoga Sutra – 2
Five Kinds of Vrittis - Pramanam - sources of right knowledge - Viparyayah – unfolded belief - Vikalpah – Unfoldedbelief - Smriti – Memory.

Unit 2

Patanjali Yoga Sutra – 3
Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4
Introduction to Samadhi - Samprajnata-Samadhi - Reasoning in Samprajnata-Samadhi - Reflection in Samprajnata- Samadhi - Bliss in Samprajnata-Samadhi - Sense of Individuality in Samprajnata-Samadhi.

Patanjali Yoga Sutra – 5
Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6
How to make mind peaceful? - Cultivating opposite virtues: happiness – friendliness - misery – compassion - virtue
– gladness - vice – indifference.

Patanjali Yoga Sutra – 7
Five causes of Pain - avidya – ignorance (Root Cause) - asmita – 'I-Feeling' – raga – attraction - dwesha – repulsion
- abhinivesha – clinging to life.

Unit 3

Patanjali Yoga Sutra – 8
Necessity of Yoga practice - eight parts of Yoga practice - five Yamas: ahimsa – satya – asteya – brahmacharyam
– aparigraha.

Patanjali Yoga Sutra – 9
Five Niyamas: Soucha – Santhosha – Tapas – Swadyah – Ishwara - Pranidhanam.
Patanjali Yoga Sutra – 10
Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses. Report review Conclusion

REFERENCES:

1. *The course book will be "The four chapters of Freedom" written by Swami Satyananda Saraswati of BiharSchool of Yoga, Munger, India.*
2. *"The message of Upanishads" written by Swami Ranganathananda. Published by Bharathiya VidyaBhavan.*
3. *Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda,Published by Advaita Ashram, Uttaranjal.*
4. *'Hatha Yoga Pradipika' Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG230	BUSINESS COMMUNICATION	L-T-P-C: 1-0-3-2

OBJECTIVES:

To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to thecross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation inbusiness contexts.

Course Outcomes

CO1: Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in theprofessional context
CO2: Understand organizational structures, pay structures and performance assessments
CO3: Apply language skills in drafting various business documents and other necessary communications in thebusiness context
CO4: Understand and address cross cultural differences in the corporate environment
CO5: Participate in planned and extempore enactments of various business situations

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										3		2
CO2									1		1	
CO3										3		
CO4						2						
CO5									2			

Syllabus

Unit 1

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles.

Unit 2

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking:Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3

Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, GroupDynamics, negotiation& persuasion techniques.
Activities
Case studies & role-plays.

BOOKS RECOMMENDED:

1. *Jones, Leo & Richard Alexander. New International Business English. CUP. 2003.*
2. *Horner, David & Peter Strutt. Words at Work. CUP. 1996.*
3. *Levi, Daniel. Group Dynamics for Teams. 3 ed. Sage Publications India Pvt. Ltd. New Delhi, 2011.*
4. *Owen, Roger. BBC Business English. BBC. 1996.*
5. *Henderson, Greta Lafollette & Price R Voiles. Business English Essentials. 7th Edition. Glencoe / McGrawHill.*
6. *Sweeney, Simon. Communicating in Business. CUP. 2000.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG231	INDIAN THOUGHT THROUGH ENGLISH	L-T-P-C: 2-0-0-2

OBJECTIVES:

To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about thesocietal changes in the recent past.

Syllabus

Unit 1

Poems
Rabindranath Tagore's Gitanjali (1-10); Nizzim Ezekiel's Enterprise; A.K. Ramanujam's Small-Scale Reflections
on a Great House.

Unit 2

Prose
Khushwant Singh's The Portrait of a Lady; Jhumpa Lahiri's Short Story - Interpreter of Maladies.

Unit 3

Drama and Speech
Vijay Tendulkar's Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan
/ A. P. J. Abdul Kalam's My Vision for India etc. (any speech).

REFERENCES:

1. *Lahiri, Jhumpa. Interpreter of Maladies, Harper Collins Publications, 2000.*
2. *Ramanujan A. K. ed. K. M. George, Modern Indian Literature: An Anthology, Vol. I, Sahitya Akademi,1992.*
3. *Singh, Khushwant. The Portrait of a Lady: Collected Stories, Penguin, 2009.*
4. *Tagore, Rabindranath. Gitanjali, Penguin Books India Pvt. Ltd, 2011.*
5. *Tendulkar, Vijay. Five Plays, Oxford University Press, 1996.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG232	INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE	L-T-P-C: 2-0-0-2

OBJECTIVES:

To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literaryinsights; to enhance creative thinking; to promote aesthetic sense.

Syllabus

Unit 1

Poems

1. W. H. Auden: Refugee Blues; 2. A. K. Ramanujan: Obituary; 3. William Blake: The LittleBlack Boy; 4. Gieve
Patel: Grandparents at a Family Get–together.

Unit 2

Short Stories

1. Chinua Achebe: Marriage is a Private Affair; 2. Ruskin Bond: The Thief; 3. Isai Tobolsky: Not Just Oranges; 4.K A Abbas: The Refugee

Unit 3

Prose

A G Gardiner: On The Philosophy of Hats; 2. Robert Lynd: Mispronunciation

Practicals:

Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Bookreviews, Movie reviews.

SUGGESTED READING:

The Old Man and the Sea, Hemingway / Any one of the novels of R.K. Narayan, etc.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG233	TECHNICAL COMMUNICATION	L-T-P-C: 2-0-0-2

OBJECTIVES:

To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand and use the basic elements of formal correspondence and methods of documentation
CO2: Learn to edit technical content for grammatical accuracy and appropriate tone and style
CO3: Use the library and internet recourses for research purposes
CO4: Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3				
CO2										3				
CO3				1										
CO4									3	3				

Syllabus:

Unit 1
Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style - graphical Representation.

Unit 2
Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3
Technical paper writing: Library research skills - documentation style - document editing – proof reading –formatting.

Practice in oral communication and Technical presentations

REFERENCES:

1. *Hirsh, Herbert. L "Essential Communication Strategies for Scientists, Engineers and TechnologyProfessionals". II Edition. New York: IEEE press, 2002*
2. *Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt BraceCollege Publication, 2003*
3. *Strunk, William Jr. and White. E B. "The Elements of Style" New York. Alliyan & Bacon, 1999.*
4. *Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (IndianAdaptation). New Delhi: Biztantra, 2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG234	INDIAN SHORT STORIES IN ENGLISH	L-T-P-C: 2-0-0-2

OBJECTIVES:

To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio- cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Syllabus

Unit 1

Introduction: Differences between novel and short stories – origin and development of short stories - Rabindranath
Tagore: Kabuliwallah; Mulk Raj Anand: The Gold Watch.

Unit 2

R. K. Narayan: Sweets for Angels; K. A. Abbas: The Refugee; Khushwant Singh: The Mark of Vishnu.

Unit 3

Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:
M. G. Narasimha Murthy (ed), Famous Indian Stories. Hyderabad: Orient Black Swan, 2014

REFERENCE:
Mohan Ramanan (Ed), English and the Indian Short Story: Essays in Criticism, Hyderabad, Orient Black Swan,2000.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23FRE230	PROFICIENCY IN FRENCH LANGUAGE (LOWER)	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Population - Identity
How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions; Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) inthe present; Interrogative sentence; Gender of adjectives.

Unit 2

The suburbs - At the train station
Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; Thecity (church, town hall, post office…)
Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3

Paris and the districts - Looking for a room
Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for thetime.
Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:
Metro St Michel - Publisher: CLE international

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23FRE231	PROFICIENCY IN FRENCH LANGUAGE (HIGHER)	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

The first room of a student
A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière,dans…), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small

jobs
Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur);Prepositions (à, pour, avec …); Pronoun as direct object (le, la, l', les).

Unit 3

University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choosea menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de….); Comparison (plus...que, moins….que, autant …que); Interrogation (continuation), inversion, Est-ce que, qu'est-ce que?.

TEXTBOOK:
Metro St Michel - Publisher: CLE International

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER230	GERMAN FOR BEGINNERS I	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation. Numbers 1-100; Saying the telephone number. Countries and Languages.
Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.
Vocabulary: Professions.

Unit 2

Giving the personal details. Name, age, marital status, year of birth, place of birth, etc. Numbers till 1000. Saying a year. Alphabets – spelling a word.
Filling up an application form; In the restaurant – making an order.
Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article Vocabulary: Food items

Unit 3

Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion. Grammar: Accusative – definite article. Adjectives and plural forms. Vocabulary: Furniture and currencies.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER231	GERMAN FOR BEGINNERS II	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form. Vocabulary: Consumables and measurements;

Unit 2

Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing upan appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers. Vocabulary: Leisure activities,weekdays, months and seasons.

Unit 3

Family and household; Family and relations; household and daily routine. Grammar: Possessive articles; Divisibleand indivisible verbs.
Vocabulary: Family circle; Household articles.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER232	PROFICIENCY IN GERMANLANGUAGE (LOWER)	L-T-P-C: 2-0-0-2

Syllabus

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able tocarry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.

(This will not be covered as part of the regular classroom teaching; this is to be acquired

by self-study.)Some useful websites will be given.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER233	PROFICIENCY IN GERMAN LANGUAGE (HIGHER)	L-T-P-C: 2-0-0-2

Syllabus

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative. Some German culture. Films.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HIN230	HINDI I	L-T-P-C: 2-0-0-2

OBJECTIVES:

To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Gain knowledge about the nature and culture of Hindi language
CO2: Understand the structural aspects of Hindi language
CO3: Apply the knowledge of the grammatical structures to communicate in Hindi
CO4: Analyse the social significance of modern literature.
CO5: Develop the ability to translate a given text to Hindi

CO-PO Mapping:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3				
CO2									2	3				
CO3									2	3				
CO4										3				
CO5									2					

Syllabus

Unit 1

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindilanguage, Devanagari script and Hindi alphabet.
Shabda Bhed, Roopanthar ki Drishti se- Bhasha – Paribhasha aur Bhed – Sangya - Paribhasha Aur Bhed - Sangyake Roopanthar - kriya.

Unit 2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation - Conversations, Interviews, Short speeches.

Unit 3

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit 4

Letter writing – personal and Formal – Translation from English to Hindi.

Unit 5

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.

BOOKS:

1. *Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi*
2. *Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi*
3. *Kamtha Prasad Guru : Hindi Vyakaran, Best Book pub House, New Delhi*
4. *Poetry : Kavya Ras - Ed: T.V. Basker - Pachouri Press; Mathura*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HIN231	HINDI II	L-T-P-C: 2-0-0-2

OBJECTIVES:

Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided asanthology.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand the grammatical structures of Hindi
CO2: Understand the post modern trends of literatureCO3: Enhance critical thinking and writing skills
CO4: Identify and analyse different literary and audio-visual material
CO5: Apply fundamental knowledge of Hindi in formal and informal writing

CO-PO Mapping:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									**1**	**2**				
CO2									**1**	**2**				
CO3									**1**	**2**				
CO4										**3**				
CO5									**1**	**2**				

Syllabus:

Unit 1

Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakth [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2

Communicative Hindi - Moukhik Abhivyakthi

Unit 3

Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. Newsreading and presentations in Radio and TV channels in Hindi.

Unit 4

Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

Translation: Theory and Practice - Letter writing: Formal and Personal – Introduction to Hindi Software.

BOOKS:

1. *Kavay Tarang: Dr. Niranjan, Jawahar Pusthakalay, Mathura.*
2. *Gadya Manjusha: Editor: Govind, Jawahar Pusthakalay, Mathura*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM230	EMOTIONAL INTELLIGENCE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Components of Emotional Intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. Emotional Intelligence Competencies, Elements of Emotional Intelligence, Models of Emotional Intelligence: The Ability-based Model, The Trait Model of Emotional Intelligence, Mixed Models of Emotional Intelligence.

Unit 3

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

REFERENCES:

1. *Daniel Goleman (1996). Emotional Intelligence- Why it can Matter More than IQ. Bantam Doubleday Dell Publishing Group*
2. *Daniel Goleman (2000). Working with Emotional Intelligence. Bantam Doubleday Dell Publishing Group*
3. *Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012). Emotional Intelligence Coaching. Kogan PageIndia Private Limited*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM231 GLIMPSES INTO THE INDAN MIND -THE GROWTH OF MODERN INDIA L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction
General Introduction; 'His + Story' or 'History' ?; The concepts of 'nation', 'national identity' and 'nationalism';Texts and Textualities: Comparative Perspectives.

Unit 2

Selected writings / selections from the complete works of the following authors will be taken up for study in achronological order:
Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3

Selected writings / selections from the complete works of the following authors will be taken up for study in achronological order:
Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.
Conclusion.

REFERENCES:

1. *Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.*
2. *Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.*
3. *Vivekananda, Swami. "Address at the Parliament of Religions"/"The Future of India"/"In Defence ofHinduism" from Selections from the Complete Works of Swami Vivekananda.*
4. *Aurobindo, Sri. The Renaissance in India / On Nationalism.*
5. *Coomaraswamy, Ananda K. Essays in Indian Idealism (any one essay) / Dance of Shiva.*
6. *Nivedita, Sister. "Noblesse Oblige: A Study of Indian Caste" / "The Eastern Mother" from The Web ofIndian Life.*
7. *Gandhi, Mahatma. Hind Swaraj.*
8. *Nehru, Jawaharlal. "The Quest" from Discovery of India.*
9. *Ambedkar, B. R. "Buddha and His Dhamma" from Collected Works.*
10. *Saraswati, Chandrasekharendra. "The Sastras and Modern Life" from The Hindu Dharma.*
11. *Dharampal. Bharatiya Chitta, Manas and Kala / Understanding Gandhi.*
12. *Naipaul, V. S. India: A Wounded Civilization / India: A Million Mutinies Now.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM232	GLIMPSES OF ETERNAL INDIA	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction
A peep into India's glorious past
Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira's ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism
– the sixteen Mahajanapadas and the beginning of Magadhan paramountcy - Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2

India's contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.
The arrival of Europeans, British paramountcy and colonization
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3

Women in Indian society
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya's Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India
The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion
The Wonder that was India; The 'politics' and 'purpose' of studying India.

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1. *Parameswaran, S. The Golden Age of Indian Mathematics. Kochi: Swadeshi Science Movement.*
2. *Somayaji, D. A. A Critical Study of Ancient Hindu Astronomy. Dharwar: 1972.*
3. *Sen, S. N. & K. V. Sarma eds. A History of Indian Astronomy. New Delhi, 1985.*
4. *Rao, S. Balachandra. Indian Astronomy: An Introduction. Hyderabad: Universities Press, 2000.*
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11. *Mahadevan, T. M. P. Invitations to Indian Philosophy. Madras: University of Madras.*
12. *Hiriyanna, M. Outlines of Indian Philosophy. Motilal Banarsidass.*
13. *Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.*
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16. *Durant, Will. The Case for India. Bangalore: Strand Book Stall, 2008.*
17. *Aurobindo, Sri. The Indian Renaissance / India's Rebirth / On Nationalism.*
18. *Nivedita, Sister. The Web of Indian Life. Kolkata: Advaita Ashrama.*
19. *Durant, Will. The Story of Civilization. Volume 1 – Our Oriental Heritage. New York: Simon & Schuster.*
20. *Ranganathananda, Swami. Eternal Values for A Changing Society. Bombay: Bharatiya Vidya Bhavan.*
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22. *Seturaman, V. S. Indian Aesthetics. Macmillan.*
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24. *Coomaraswamy, Ananda K. Essays on Indian Idealism. New Delhi: Munshiram Manoharlal.*
25. *Danino, Michel. The Invasion That Never Was.*
26. *Kautilya. Arthasastra.*
27. *Altekar, A. S. State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
28. *Altekar, A. S. The Position of Women in Hindu Civilization. New Delhi: Motilal Banarsidass.*
29. *Sircar, D. C. Studies in the Religious Life of Ancient and Medieval India. New Delhi: Motilal Banarsidass.*
30. *Sircar, D. C. Studies in the Political and Administrative Systems in Ancient and Medieval Times.NewDelhi: Motilal Banarsidass.*
31. *Madhavananda, Swami & R. C. Majumdar eds. The Great Women of India. Kolkata: Advaita Ashrama.*
32. *Dutt, R. C. The Economic History of India. London, 1902.*
33. *Dharampal. Collected Works.*
34. *Dharampal. Archival Compilations (unpublished)*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM233	GLIMPSES OF INDIAN ECONOMY AND POLITY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.
Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2

Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra; of Politics and trade –the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.
Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3

Modern India: 1720 - 1947
the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was 'traditional' or 'Indian') – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large- scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations
– division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947
India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact ofscience and (new/ emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.
Conclusion

REFERENCES:

1. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.Kautilya. Arthasastra.*
2. *Altekar, A. S. State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
3. *Sircar, D. C. Studies in the Political and Administrative Systems in Ancient and Medieval Times. NewDelhi: Motilal Banarsidass.*
4. *Dutt, R. C. The Economic History of India. London, 1902.*
5. *Dharampal. Collected Works (Volumes IV & V).*
6. *Dharampal. Archival Compilations (unpublished).*
7. *Bajaj, Jitendra & M. D. Srinivas. Indian Economy and Polity. Chennai: Centre for Policy Studies.*
8. *Bajaj, Jitendra & M. D. Srinivas. Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
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10. *Tripathi, Dwijendra. The Oxford History of Indian Business. New Delhi: Oxford University Press, 2004.*
11. *McGuire, John, et al, eds. Evolution of World Economy, Precious Metals and India. New Delhi: OxfordUniversity Press, 2001.*
12. *Tripathi, Dwijendra and Jyoti Jumani. The Concise Oxford History of Indian Business. New Delhi: Oxford University Press, 2007.*
13. *Kudaisya, Medha M. The Life and Times of G. D. Birla. New Delhi: Oxford University Press, 2003.*
14. *Raychaudhuri, Tapan and Irfan Haib, eds. The Cambridge Economic History of India. Volume*
15. *New Delhi: Orient Longman, 2004.*
16. *Kumar, Dharma, ed. The Cambridge Economic History of India. Volume 2. New Delhi: Orient Longman,2005.*
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18. *Mambro, Arvind ed. J. R. D. Tata: Letters. New Delhi: Rupa & Co., 2004.*
19. *Lala, R. M., For the Love of India: The Life and Times of Jamsetji Tata. New Delhi: Penguin, 2006.*
20. *Thapar, Romila. The Penguin History of Early India: From the Origins to AD 1300. New Delhi Penguin,2002.*
21. *Majumdar, R. C., et. al. An Advanced History of India. Macmillan.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM234	HEALTH AND LIFESTYLE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction to Health
Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2

Food and Nutritional Requirements during Adolescence
Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern andpostures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3

Need for a Positive Life Style Change
Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

1. *B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.*
2. *"Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Councilof Medical Research, ICMR, 2010.*

REFERENCE BOOKS:

1. *K Park "Textbook of preventive and social medicine", 2010.*
2. *WHO Report on Adolescent Health: 2010*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM235	INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2

The relevance of these classics in a modern age.

Unit 3

Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM236	INTRODUCTION TO INDIA STUDIES	L-T-P-C: 2-0-0-2

PREAMBLE:

This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Syllabus

Unit 1

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:
Material given by the Faculty

BACKGROUND LITERATURE:

1. *Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture(Kolkata) publication.*
2. *Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.*
3. *Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.*
4. *Outlines of Indian Philosophy, M. Hiriyanna, MLBD.*
5. *An Advanced History of India, R. C. Majumdar et al, Macmillan.*
6. *India Since 1526, V. D. Mahajan, S. Chand & Company*
7. *The Indian Renaissance, Sri Aurobindo.*
8. *India's Rebirth, Sri Aurobindo.*
9. *On Nationalism, Sri Aurobindo.*
10. *The Story of Civilization, Volume I: Our Oriental Heritage, Will Durant, Simonand Schuster, New York.*
11. *Eternal Values for a Changing Society, Swami Ranganathananda, Bharatiya Vidya Bhavan.*
12. *Universal Message of the Bhagavad Gita, Swami Ranganathananda, Advaita Ashrama.*
13. *Awaken Children: Conversations with Mata Amritanandamayi*
14. *Indian Aesthetics, V. S. Seturaman, Macmillan.*
15. *Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.*

16. *Web of Indian Thought, Sister Nivedita*
17. *Essays on Indian Nationalism, Anand Kumaraswamy*
18. *Comparative Aesthetics, Volume 2, Kanti Chandra Pandey, Chowkhamba, Varanasi*
19. *The Invasion That Never Was, Michel Danino*
20. *Samskara, U. R. Ananthamurthy, OUP.*
21. *Hayavadana, Girish Karnard, OUP*
22. *Naga-Mandala, Girish Karnard, OUP.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM237	INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE	L-T-P-C: 2-0-0-2

OBJECTIVES:

To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit;to help students appreciate and imbibe India's ancient culture and values.

Syllabus

Unit 1

Sanskrit Language – Vakya Vyavahara (प्रथमादीक्षा) Introduction to Sanskrit language - Devanagari script and Sanskrit alphabet - Vowels and Consonants – Pronunciation - Classification of Consonants – Samyukthakshara Words – Nouns and Verbs - Cases – Introduction to Numbers and Time – Verbs: Singular, Dual and Plural – SarvaNamas: First Person, Second Person, Third Person – Tenses: Past, Present and Future -Words for Communication – Selected Slokas – MoralStories – Subhashithas – Riddles.

Unit 2

Language Studies - Role of Sanskrit in Indian & World Languages.

Unit 3

Introduction to Sanskrit Classical Literature – KavyaTradition – Drama Tradition - Stotra Tradition – Panchatantra Stories.

Unit 4

Introduction to Sanskrit Technical Literature – Astronomy – Physics – Chemistry – Botany – Engineering – Aeronautics – Ayurveda – Mathematics – Medicine – Architecture - Tradition of Indian Art – Administration –Agriculture.

Unit 5

Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:

1. *Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi*
2. *The Wonder that is Sanskrit - Dr.Sampadananda Mishra, New Delhi*
3. *Science in Sanskrit – Samskritha Bharathi, NewDelhi*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM238	NATIONAL SERVICE SCHEME	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.
NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2

Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3

Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.
Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

Unit 4

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.
Youth and Crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice.

Unit 5

Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.
Project Work / Practical

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM239	PSYCHOLOGY FOR EFFECTIVE LIVING	L-T-P-C: 2-0-0-2

Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1						1
CO2						2	3		3	3		
CO3						3	3	2	1		3	2
CO4						2	2	3				1
CO5						1	2				1	1

Syllabus

Unit 1

Self-Awareness & Self-Motivation
Self analysis through SWOT, Johari Window, Maslow's hierarchy of motivation, importance of self esteem andenhancement of self esteem.

Unit 2

The Nature and Coping of Stress
Conflict, Relationship issues, PTSD. Stress – stressors – eustress - distress, coping with stress, stress managementtechniques.

Unit 3

Application of Health Psychology
Health compromising behaviours, substance abuse and addiction.

TEXTBOOKS:

1. *V. D. Swaminathan & K. V. Kaliappan "Psychology for effective living - An introduction to Health*
2. *Psychology. 2nd edition Robert J. Gatchel, Andrew Baum & David S. Krantz, McGraw Hill.*

REFERENCE BOOKS:

1. *S. Sunder, 'Textbook of Rehabilitation', 2nd edition, Jaypee Brothers, New Delhi. 2002.*
2. *Weiben & Lloyd, 'Psychology applied to Modern Life', Thompson Learning, Asia Ltd.2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM240	PSYCHOLOGY FOR ENGINEERS	L-T-P-C: 2-0-0-2

Course Objectives:

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.
CO 2: Apply the principles of psychology in day- to- day life for a better understanding of oneself and others.
CO 3: Apply the knowledge of Psychology to improve study skills and learning methods
CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3	3		3	2		1
CO2						3	3	2	3	3	1	2
CO3										2	1	
CO4							3		2	2		2

Syllabus

Unit 1

Psychology of Adolescents: Adolescence and its characteristics.

Unit 2

Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills, Mnemonics.

Unit 3

Attention & Perception: Definition, types of attention, perception.

TEXTBOOKS:

1. *S. K. Mangal, "General Psychology", Sterling Publishers Pvt. Ltd.2007*
2. *Baron A. Robert, "Psychology", Prentice Hall of India. New Delhi 2001*

REFERENCE BOOKS:

1. *Elizabeth B. Hurlock, Developmental Psychology - A life span approach, 6th edition.*
2. *Feldman, Understanding Psychology, McGraw Hill, 2000.*
3. *Clifford Morgan, Richard King, John Scholper, "Introduction to Psychology", Tata Mcgraw Hill, PvtLtd 2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM241	SCIENCE AND SOCIETY - AN INDIAN PERSPECTIVE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction
Western and Indian views of science and technology
Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science andtechnology: an overview.

Unit 2

Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD

Science and technology under the British rule
Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building ofNew Delhi

Unit 3

Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and thedetermination.

Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

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1. *Joseph, George Gheverghese. The Crest of the Peacock: Non-European Roots of Mathematics. London:Penguin (UK), 2003.*
2. *Iyengar, C. N. Srinivasa. History of Hindu Mathematics. Lahore: 1935, 1938 (2 Parts).*
3. *Amma, T. A. Saraswati. Geometry in Ancient and Medieval India. Varanasi: Motilal Banarsidass, 1979.*
4. *Bag, A. K. Mathematics in Ancient and Medieval India. Varanasi: Motilal Banarsidass, 1979.*
5. *Sarma K. V. & B. V. Subbarayappa. Indian Astronomy: A Source-Book. Bombay: Nehru Centre, 1985.*
6. *Sriram, M. S. et. al. eds. 500 Years of Tantrasangraha: A Landmark in the History of Astronomy. Shimla:Indian Institute of Advanced Study, 2002.*
7. *Bajaj, Jitendra & M. D. Srinivas. Restoring the Abundance: Regeneration of Indian Agriculture toEnsure Food for All in Plenty.Shimla: Indian Institute of Advanced Study, 2001.*
8. *Bajaj, Jitendra ed. Report of the Seminar on Food for All: The Classical Indian Discipline of Growingand Sharing Food in Plenty. Chennai: Centre for Policy Studies, 2001.*

9. *Bajaj, Jitendra & M. D. Srinivas. Annam Bahu Kurvita: Recollecting the Indian Discipline of Growingand Sharing Food in Plenty. Madras: Centre for Policy Studies, 1996.*
10. *Parameswaran, S. The Golden Age of Indian Mathematics. Kochi: Swadeshi Science Movement.*
11. *Somayaji, D. A. A Critical Study of Ancient Hindu Astronomy. Dharwar: 1972.*
12. *Sen, S. N. & K. V. Sarma eds. A History of Indian Astronomy. New Delhi, 1985.*
13. *Rao, S. Balachandra. Indian Astronomy: An Introduction. Hyderabad: Universities Press, 2000.*
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17. *Joshi, Murli Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*
18. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*

** The syllabus and the study material in use herein has been developed out of a 'summer programme' offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas,Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM242	THE MESSAGE OF BHAGWAD GITA	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha. ArjunaVishada Yoga: Arjuna's Anguish and Confusion – Symbolism of Arjuna's Chariot.

Sankhya Yoga: Importance of Self-knowledge – Deathlessness: Indestructibility of Consciousness – Being Established in Wisdom – Qualities of a Sthita-prajna.

Unit 2

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Conceptof Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine – Inner Qualities of a True Devotee.

GunatrayaVibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva – Going Beyond the Three Gunas –Description of a Gunatheetha.

TEXTBOOKS / REFERENCES:

1. *Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust, 2002.*
2. *Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust, 2001.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM243	THE MESSAGE OF THE UPANISHADS	L-T-P-C: 2-0-0-2

OBJECTIVES:

To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Syllabus

Unit 1

An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2

The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – the Moving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

Unit 3

Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada's answers to the six questions in Prasnopanishad.

REFERENCES:

1. *The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan*
2. *Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama*
3. *Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press*
4. *Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore*
5. *Upanishads in Daily Life, Sri Ramakrishna Math, Mylapore.*
6. *Eternal stories of the Upanishads by Thomas Egenes and Kumuda Reddy*
7. *Upanishad Ganga series – Chinmaya Creations*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM244	UNDERSTANDING SCIENCE OF FOOD AND NUTRITION	L-T-P-C: 2-0-0-2

Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergic foodcombinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food,allergic food, , food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.

Course Outcome:

CO1: Acquire knowledge about the various food and food groups
CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.CO3: Understand the significance of safe food and apply the food safety standards
CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1		1	1			1	2	1	1	1	1	3
CO 2		1	1			1	1	1	1	1	1	3
CO 3		1	1			1	1	1	1	1	1	3
CO 4		1	1			1	1	1	1	1	1	3
CO 5		1	1			1	2	1	2	1	1	3

Syllabus

Unit 1

Food and Food Groups
Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.

Cookery Practicals - Balanced Diet

Unit 2

Nutrients and Nutrition
Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

Practicals - Traditional Foods

Unit 3

Introduction to Food Biotechnology

Future foods - Organic foods and genetically modified foods, Fortification of foods value addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advancedresearch.

Practicals - Value added foods

TEXTBOOKS:

1. *N. Shakuntalamanay, M. Shadaksharaswamy, "Food Facts and principles", New age international (P)ltd, publishers, 2005.*
2. *B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.*

REFERENCE BOOKS:

1. *B. Srilakshmi, "Food Science", New age international (P) ltd, publishers, 2008.*
2. *"Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Councilof Medical Research, ICMR, 2010.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23JAP230	PROFICIENCY IN JAPANESE LANGUAGE (LOWER)	L-T-P-C: 2-0-0-2

Syllabus

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23JAP231	PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)	L-T-P-C: 2-0-0-2

Syllabus

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23KAN230	KANNADA I	L-T-P-C: 2-0-0-2

OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills andreading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary,spelling, punctuation and speech.

Syllabus

Unit 1

Adalitha Kannada: bhashe, swaroopa, belavanigeya kiru parichaya Paaribhaashika padagalu Vocabulary Building

Unit 2

Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao

Prabhandha – Baredidi…baredidi, Baduku mugiyuvudilla allige…- Nemi Chandra Paragraph writing – Development: comparison, definition, cause & effect Essay – Descriptive & Narrative

Unit 3

Mochi – Bharateepriya
Mosarina Mangamma – Maasti Venkatesh Iyengar Kamalaapurada Hotelnalli – Panje Mangesh Rao
Kaanike – B.
M. Shree
Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa Moodala Mane – Da.
Ra. BendreSwathantryada Hanate – K. S. Nissaar Ahmed

Unit 4

Letter Writing - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5

Reading Comprehension; nudigattu, gaadegalu Speaking Skills: Prepared speech, pick and speak

REFERENCES:

1. *H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru*
2. *N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste*
3. *Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication*
4. *Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru*
5. *B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu*
6. *K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.*
7. *Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23KAN231	KANNADA II	L-T-P-C: 2-0-0-2

OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Syllabus

Unit 1

Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2

Nanna Hanate - Dr. G. S. Shivarudrappa

Mankuthimmana Kaggada Ayda bhagagalu – D. V. Gundappa (Padya Sankhye 5, 20, 22, 23, 25, 44, 344, 345, 346, 601)
Ella Marethiruvaga - K. S. Nissaar Ahmed Saviraru Nadigalu – S Siddalingayya

Unit 3

Sayo Aata – Da. Ra. Bendre

Unit 4
Sarva Sollegala turtu Maha Samelana - Beechi Swarthakkaagi Tyaga - Beechi

Unit 5

Essay writing: Argumentative & Analytical Précis writing

REFERENCES:

1. *H. S. Krishnaswami Iyangar – Adalitha Kannada – Chetan Publication, Mysuru*
2. *Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana*
3. *Shrikanth - Mankuthimmana Kagga – Taatparya – Sri Ranga Printers & Binders*
4. *K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house*
5. *Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication*
6. *Beechi – Sahukara Subbamma – Sahitya Prakashana*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAL230	MALAYALAM I	L-T-P-C: 2-0-0-2

Course Objectives:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother0-tongue; to learn ourculture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality

Course Outcome:

After the completion of the course the student will be able to:

CO1: Understand and inculcate philosophical thoughts and practices
CO2: Understand and appreciate the post modern trends of literature.
CO3: Analyse the literary texts and comprehend the cultural diversity of Kerala
CO4: Distinguish the different genres in Malayalam literature
CO5: Demonstrate the ability to effectively communicate in Malayalam

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO2	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO3	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	-	-	-	-	-	-	**1**	**1**	-	-

Syllabus

Unit 1

Ancient poet trio: Adhyatmaramayanam,

Lakshmana Swanthanam (valsa soumitre… mungikidakayal), Ezhuthachan - Medieval period classics –Jnanappana (kalaminnu… vilasangalingane), Poonthanam

Unit 2

Modern Poet trio: Ente Gurunathan, Vallathol Narayana Menon - Critical analysis of the poem.

Unit 3

Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures ofKerala and about their literary contributions.

Unit 4

Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5

Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam Writing - a. Expansion of ideas; b . Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script /Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. *P. K. Balakrishnanan, Thunjan padhanangal, D. C. Books, 2007.*
2. *G. Balakrishnan Nair, Jnanappanayum Harinama Keerthanavum, N. B. S, 2005.*
3. *M. N. Karasseri, Basheerinte Poonkavanam, D. C. Books, 2008.*
4. *4 M. N. Vijayan, Marubhoomikal Pookkumbol, D. C. Books, 2010.*
5. *M. Thomas Mathew, Lavanyanubhavathinte Yukthisasthram, National Book Stall, 2009.*
6. *M. Leelavathy, Kavitha Sahityacharitram, National Book Stall, 1998.*
7. *Thayattu Sankaran, Vallathol Kavithapadhanam, D. C. Books, 2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAL231	MALAYALAM II	L-T-P-C: 2-0-0-2

OBJECTIVES:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn ourculture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; tocreate awareness that good language is the sign of complete personality.

Course Outcome:

After the completion of the course the student will be able to:

CO1: Understand the different cultural influences in linguistic translation
CO2: Identify and appreciate the Romantic elements of modern literature
CO3: Analyze the genre of autobiographical writing
CO4: Critically evaluate the significance of historical, political and socio-cultural aspects in literatureCO5: Demonstrate good writing skills in Malayalam

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO2	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO3	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO4	-	-	-	-	-	-	-	-	**-**	**3**	-	-
CO5	-	-	-	-	-	-	-	-	**1**	**1**	-	-

Syllabus

Unit 1

Ancient poet trio: Kalayanasougandhikam, (kallum marangalun… namukkennarika vrikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Translated by Attor Krishna Pisharody).

Unit 2

Modern / romantic / contemporary poetry: Manaswini, Changampuzha Krishna Pillai – Romanticism – modernism.

Unit 3

Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4

Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

Unit 5

Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam Writing - a. Expansion of ideas; b. Précis Writing ; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script /Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. *Narayana Pillai. P. K, Sahitya Panchanan. Vimarsanathrayam, Kerala Sahitya Academy, 2000*
2. *Sankunni Nair. M. P, Chathravum Chamaravum, D. C. Books, 2010.*
3. *Gupthan Nair. S, Asthiyude Pookkal, D. C Books. 2005*
4. *Panmana Ramachandran Nair, Thettillatha Malayalam, Sariyum thettum etc., D. C. Book, 2006.*
5. *M. Achuthan, Cherukatha-Innale, innu, National Book Stall, 1998.*
6. *N. Krishna Pillai, Kairaliyude Katha, National Book Stall, 2001.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SAN230	SANSKRIT I	L-T-P-C: 2-0-0-2

OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self- study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus

Unit 1

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

Unit 2

Verbs- Singular, Dual and plural – First person, Second person, Third person. Tenses – Past, Present and Future –Atmanepadi and Parasmaipadi-kartharipra yoga

Unit 3

Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4

Selected slokas from Valmiki Ramayana, Kalidasa's works and Bhagavad Gita. Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa's Sakuntalam Act IV – verse 4

Unit 5

Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. *Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560085*
2. *Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad*
3. *Prakriya Bhashyam written and published by Fr. John Kunnappally*
4. *Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston*
5. *Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad*
6. *Namalinganusasanam by Amarasimha published by Travancore Sanskrit series*
7. *Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar press*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SAN231	SANSKRIT II	L-T-P-C: 2-0-0-2

OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self- study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus

Unit 1

Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2

Ktavatu Pratyaya, Upasargas, Ktvanta, Tumunnanta, Lyabanta. Three Lakaras – brief introduction, Lot lakara.

Unit 3

Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4

Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas- Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa's Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5

Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. *Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560085*
2. *Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad*
3. *Prakriya Bhashyam written and published by Fr. John Kunnappally*
4. *Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston*
5. *Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad*
6. *Namalinganusasanam by Amarasimha published by Travancore Sanskrit series*
7. *Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar Press.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SWK230	CORPORATE SOCIAL RESPONSIBILITY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2

CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3

Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

1. *Corporate Governance, Ethics and Social Responsibility, V Bala Chandran and V Chandrasekaran, PHI learning Private Limited, New Delhi 2011.*
2. *White H. (2005) Challenges in evaluating development effectiveness: Working paper 242, Institute of Development Studies, Brighton.*
3. *UNDP (nd) Governance indicators: A users guide. Oslo: UNDP*
4. *Rao, Subbha (1996) Essentials of Human Resource Management and Industrial Relations, Mumbai,Himalaya*
5. *Rao, V. S. L. (2009) Human Resource Management, New Delhi, Excel Books*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SWK231	WORKPLACE MENTAL HEALTH	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2

Mental Health Issues in the Workplace: Emotions, Common emotions at the workplace, Mental Health issues - Anger, Anxiety, Stress & Burnout, Depression, Addictions – Substance and Behavioural, Psychotic Disorders - Schizophrenia, Bipolar Disorder, Personality disorders. Crisis Situations - Suicidal behavior, panic attacks, reactions to traumatic events. Stigma and exclusion of affected employees. Other issues –work-life balance, Presenteeism, Harassment, Bullying, Mobbing. Mental Health First Aid - Meaning. Case Study, Activity.

Unit 3

Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being-corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals-talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

REFERENCES:

1. *American Psychiatric Association. "Diagnostic and statistical manual of mental disorders: DSM-IV 4th ed." www.terapiacognitiva.eu/dwl/dsm5/DSM-IV.pdf*
2. *American Psychiatric Association. (2000) www.ccsa.ca/Eng/KnowledgeCentre/OurDatabases/ lossary/Pages/index.aspx.*
3. *Canadian Mental Health Association, Ontario "Workplace mental health promotion, A how toguide"wmhp.cmhaontario.ca/*
4. *Alberta Health Services Mental Health Promotion. (2012). Minding the Workplace: Tips for employeesand managers together. Calgary: Alberta Health Services.http:// www.mentalhealthpromotion.net/resources/minding-the-workplace-tips-for-employees-and- managers- together.pdf*
5. *Government of Western Australia, Mental Health Commission. (2014) "Supporting good mental health in the work place." http://www.mentalhealth.wa.gov.au/Libraries/pdf_docs/ supporting_good_mental_health_in_the_workplace_1.sflb.ashx*
6. *Mental Health Act 1987 (India) www.tnhealth.org/mha.htm*
7. *Persons with disabilities Act 1995 (India) socialjustice.nic.in*
8. *The Factories Act 1948 (India) www.caaa.in/Image/19ulabourlawshb.pdf*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23TAM230	TAMIL I	L-T-P-C: 2-0-0-2

Course Objectives:

- To introduce the students to different literature- Sangam literature, Epics, Bhakthi literature and modern literature.
- To improve their ability to communicate with creative concepts, and also to introduce them to theusefulness of basic grammatical components in Tamil.

Course Outcomes

CO 1: To understand the Sangam literature
CO 2: To understand the creative literature
CO 3: To understand the literary work on religious scriptures
CO 4: To improve the communication and memory skills
CO 5: To understand the basic grammar components of Tamil language and their usage and applications.
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

Syllabus

Unit1

The history ofTamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35.
Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi, periyāraittuṇakkōṭal, viḻippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.
Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7, , maṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūṟṟu ayaṟkūṟṟu

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṉi payaṉpāṭu. - Karuttu parimāṟṟam - viḻampara moḻiyamaippu – pēccu - nāṭakam paṭaippu -ciṟukatai, katai, putiṉam paṭaippu.

Textbooks:

1. *http:/Www.tamilvu.trg/libirary/libindex.htm.*
2. *http:/Www.tunathamizh.tom/2013/07/blog0post_24.html*
3. *Mu.Varatarācaṉ "tamiḻ ilakkiya varalāṟu" cāhitya akaṭemi papḷikēṣaṉs, 2012*
4. *nā.Vāṉamāmalai "paḻaṅkataikaḷum, paḻamoḻikaḷum" niyū ceñcuri puttaka veḷiyīṭṭakam,*
5. *1980,2008*
6. *nā.Vāṉamāmalai, "tamiḻar nāṭṭuppāṭalkaḷ" niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006*
7. *poṉ maṇimāṟaṉ "aṭōṉ tamiḻ ilakkaṇam "aṭōṉ papḷiṣiṅ kurūp, vañciyūr,*
8. *tiruvaṉantapuram, 2007.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23TAM231	TAMIL II	L-T-P-C: 2-0-0-2

Course Objectives

- To learn the history of Tamilliterature.
- To analyze different styles of Tamil Language.
- To strengthen the creativity in communication, Tamil basic grammar and use of computer on TamilLanguage.

Course Outcomes

CO 1: Understand the history of Tamil literature.

CO 2: Apply practical and comparative analyses on literature.

CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature

CO 4: Understand the tamil scholars' service to Tamil language and society.

CO 5: Understand components of Tamil grammar and its usage

CO 6: Understand creative writing aspects and apply them

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			-	-	-	-	-	-	2	2	-	-
CO2			-	-	-	-	-	-	2	2	-	-
CO3			-	-	-	-	-	-	2	2	-	-
CO4			-	-	-	-	-	-	2	2	-	-
CO5			-	-	-	-	-	-	2	2	-	-
CO6			-	-	-	-	-	-	2	2	-	-

Syllabus

Unit 1

The history of
Tamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35. Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi,

periyāraittuṇakkōṭal, viḻippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.
Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7,8), marrum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūrru ayaṟkūrru

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṉi payaṉpāṭu. - Karuttu parimārram - viḻampara moḻiyamaippu – pēccu - nāṭakam paṭaippu - ciṟukatai, katai, putiṉam paṭaippu.

Text Books / References

http:/Www.tamilvu.trg/libirary/libindex.htm.
http:/Www.tunathamizh.tom/2013/07/blog0post_24.html Mu.Varatarācaṉ "tamiḻ ilakkiya varalāṟu" cāhitya akaṭemi papḷikēṣaṉs, 2012
nā.Vāṉamāmalai "paḻaṅkataikaḷum, paḻamoḻikaḷum" niyū ceñcuri puttaka veḷiyīṭṭakam, 1980,2008 nā.Vāṉamāmalai, "tamiḻar nāṭṭuppāṭalkaḷ" niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006 poṉ maṇimāṟaṉ "aṭōṉ tamiḻ ilakkaṇam "aṭōṉ papḷiṣiṅ kurūp, vañciyū

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.