AMRITA VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY
School of Engineering

CHENNAI CAMPUS

B. Tech - Computer Science and Engineering (Cyber Security)

(BTC-CYS)

Curriculum and Syllabi

2020

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
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 master's 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	19ENG111	Technical Communication	2 0 3	3
ENGG	20CYS101	Classical Cryptography	2 0 0	2
MAT	20MAT102	Linear Algebra	3 1 0	4
SCI	19PHY101	Engineering Physics	2 1 0	3
ENGG	19CSE100	Problem Solving and Algorithmic Thinking	2 1 3	4
ENGG	20CYS102	Principles of Engineering	2 0 3	3
ENGG	20CYS103	Computer Hardware and System Essentials	2 0 3	3
HUM	19CUL101	Cultural Education – 1	2 0 0	2
Total (17 L + 3 T + 12 P = 32 hrs)				24

SEMESTER II

Cat	Code	Title	L T P	Credit
MAT	19MAT115	Discrete Mathematics	3 1 0	4
MAT	20MAT112	Number Theory and Algebra	3 0 0	3
ENGG	20CYS111	Digital Signal Processing	2 1 0	3
ENGG	20CYS112	Computer Organisation and Architecture	3 0 3	4
ENGG	20CYS113	Computer Programming	3 0 0	3
ENGG	20CYS181	Computer Programming lab	0 0 3	1
ENGG	20CYS114	Cyber Security Essentials	2 0 3	3
HUM	19CUL111	Cultural Education – II	2 0 0	2
Total (18L + 2T + 9P = 29hrs)				23

SEMESTER III

Cat	Code	Title	L T P	Credit
MAT	20CYS201	Optimization Techniques	3 1 0	4
ENGG	20CYS202	User Interface Design	1 0 3	2
ENGG	20CYS203	Operating Systems	3 0 0	3
ENGG	20CYS281	Operating System Lab	0 0 3	1
ENGG	19CSE201	Advanced Programming	2 0 3	3
ENGG	20CYS204	Database Management System	2 0 3	3
ENGG	20CYS205	Modern Cryptography	3 1 0	4
HUM	19AVP201	Amrita Value Program I	1 0 0	1
Total (15 L + 2 T + 12 P = 29 hrs)				21

SEMESTER IV

Cat	Code	Title	L T P	Credit
SCI	20CYS211	Probability and Statistics	3 1 0	4
ENGG	20CYS212	Multimedia Processing	2 0 3	3
ENGG	20CYS213	System Security	3 0 0	3
ENGG	20CYS282	System Security Lab	0 0 3	1
ENGG	19CSE305	Machine Learning	2 0 3	3
ENGG	20CYS214	Data Structures and Algorithms	3 0 0	3
ENGG	20CYS283	Data Structures and Algorithms Lab	0 0 3	1
HUM	19AVP211	Amrita Value Program II	1 0 0	1
HUM		Humanities Elective	2 0 0	2
HUM	19SSK211	Soft Skills – 1	1 0 3	2
HUM	19MNG300	Disaster Management	-	P/F
Total (17 L + 1T + 15 P = 33hrs)				23

SEMESTER V

Cat	Code	Title	L T P	Credit
ENGG	20CYS301	Digital Communication	3 0 0	3
ENGG	20CYS302	Secure Coding	3 0 0	3
ENGG	20CYS381	Secure Coding Lab	0 0 3	1
ENGG	19CSE302	Design and Analysis of Algorithms	3 0 0	3
ENGG	20CYS303	Computer Networks	3 0 0	3
ENGG	20CTS382	Computer Networks lab	0 0 3	1
ENGG	20CYS304	Artificial Intelligence and Neural Networks	3 0 3	4
ENGG	20CYS383	Java Programming Lab	0 0 3	1
HUM	19SSK301	Soft Skills – 2	1 0 3	2
HUM	19ENV300	Environmental Science	-	P/F
ENGG	19LIV390	Live – in – Labs		[3]
Total (16 L + 0T + 15 P = 31 hrs)				21+[3]

SEMESTER VI

Cat	Code	Title	L T P	Credit
ENGG	20CYS311	Cyber Forensics	2 0 3	3
ENGG	20CYS312	Principles of Programming Languages	2 0 3	3
ENGG	20CYS384	Advanced Protocol Engineering and Security Lab	0 0 3	1
ENGG	20CYS313	Network Security	3 0 0	3
ENGG	20CYS314	Applied Cryptography	3 1 0	4
ENGG	20CYS315	Automata Theory and Compiler Design	2 0 3	3
ENGG		Professional Elective – 1	3 0 0	3
HUM	19SSK311	Soft Skills – 3	1 0 3	2
ENGG	19LIV490	Live-in-Labs		[3]
Total (16L + 1T +15P = 32 hrs)				22+[3]

SEMESTER VII

Cat	Code	Title	L T P	Credit
ENGG	20CYS401	Secure Software Engineering	2 0 3	3
ENGG	20CYS402	Distributed Systems and Cloud Computing	2 0 3	3
ENGG	20CYS403	Web Application Security	2 0 3	3
ENGG	20CYS404	Android Application Development	0 0 3	1
ENGG		Professional Elective – 2	3 0 0	3
ENGG		Professional Elective – 3	3 0 0	3
ENGG		Free Elective – 1 (Management Elective)	3 0 0	3
PRJ	2OCYS495	Project - Phase – 1 / Seminar		2
HUM	19LAW300	Indian Constitution	-	P/F
Total (15L+0T+12P = 27hrs)				21

SEMESTER VIII

Cat	Code	Title	L T P	Credit
PRJ	20CYS499	Project - Phase – 2	0 0 30	10
Total (30hrs)				10
Total Credits				165

***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
Professional Elective-1				
ENGG	**20CYS331**	**Wireless Sensor Network Security**	**3 0 0**	**3**
ENGG	**19CSE436**	**Mobile and Wireless Security**	**3 0 0**	**3**
ENGG	**19CSE446**	**Internet of Things**	**2 0 3**	**3**
Professional Elective-2				
ENGG	**20CYS431**	**Program Obfuscation**	**3 0 0**	**3**
ENGG	**20CYS432**	**Vulnerability Assessment and Penetration Testing**	**3 0 0**	**3**
ENGG	**20CYS433**	**Blockchain Technology**	**2 0 3**	**3**
Professional Elective-3				
ENGG	**20CYS441**	**Formal Methods for Security**	**3 0 0**	**3**
ENGG	**20CYS442**	**Hardware Security**	**3 0 0**	**3**
ENGG	**20CYS443**	**Biometrics and Security**	**3 0 0**	**3**

SYLLABUS

SEMESTER I

19ENG111	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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	20	
Periodical 2	20	
Continuous Assessment (Lab) (CAL)	40	
End Semester		20

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS101	CLASSICAL CRYPTOGRAPHY	L-T-P-C: 2-0-0-2

Pre-Requisite(s): Nil

Course Objectives

- The course will cover how classical cryptography work, how security is analyzed theoretically
- It will also present cryptanalysis attacks against the cryptographic techniques, and attack models.
- Understand the impact of these ciphers on society during the time of their use

Course Outcomes

CO1: Identify the basic language of cryptography
CO2: Encrypt and decrypt messages using various ciphers with classical cryptography.
CO3: Understand cryptanalysis of classical cryptography.

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	
CO5														

Syllabus

Transposition Ciphers, Columnar Transposition, keyword Columnar Transposition, Double transposition ciphers, Substitution Ciphers, Simple substitution ciphers, Poly-alphabetic ciphers, Affine ciphers, Simple substitution cryptanalysis, Vigenere Ciphers, Index of coincidence, Hill cipher, One time pad, Code book ciphers, Enigma, Rotors, Enigma attack, Purple, Decrypting Purple, Sigaba cipher, LFSR based shift registers, Berlekamp-Massey Algorithm

Textbook

Applied cryptanalysis, Mark Stamp and Richard M. Iow, Wiley-Interscience, 2007

Reference(s)

1. *Stinson, Douglas Robert, and Maura Paterson, Cryptography: Theory and Practice, CRC press, 2018.*
2. *A. J. Menezes, P. C. V. Oorschot and S. A. Vanstone, Handbook of Applied Cryptography, CRC Press, 1996.*

Evaluation Pattern (50:50)

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
Continuous Assessment (CAL)	20	
End Semester		50

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

20MAT102	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: Understand the basic concepts of vector space, subspace, basis and dimension.
CO2: Understand the basic concepts of inner product space, norm, angle, Orthogonality and projection and implementing the Gram-Schmidt process, to obtain least square solution.
CO3: Understand the concept of linear transformations, the relation between matrices and linear transformations, kernel, range and apply it to change the basis, to get the QR decomposition, and to transform the given matrix to diagonal/Jordan canonical form.
CO4: Understand the concept of positive definiteness, matrix norm and condition number for a given square matrix.

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

Review: 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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

19PHY101	ENGINEERING PHYSICS	L-T-P-C: 2-1-0-3

Pre-Requisite(s): Nil

Course Objective

- To learn fundamental concepts of electricity and magnetism for applications in engineering and technology.
- To familiarize the principles of interference, diffraction and polarization and apply in engineering context.
- To gain knowledge of basic quantum mechanics, crystal structure and classification of solids based on their properties and applications.

Course Outcomes

CO1: Be able to apply the concepts of electric and magnetic field including Maxwell's equations to engineering application and problem solving.
CO2: Understand the principles of interference, diffraction and polarization and apply it in engineering context and to solve numerical problems.
CO3: Understand the principles and applications of solid state and gas lasers.
CO4: Be exposed to basic principles of Quantum mechanics with elementary applications in one dimensional potential well.
CO5: Be familiar with crystals structure, free electron theory and basic semiconductor theory.

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								2		
CO2	3	3	2	3								2		
CO3	3	3	2	3								2		
CO4	3	3	2	3								2		
CO5	3	3	2	3								2		

Syllabus

Unit 1

Electrostatics, Magnetostatics and Electrodynamics
Electric field and electrostatic potential for a charge distribution, divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Biot-Savart law, divergence and curl of static magnetic field, vector potential, Stoke's theorem, Lorentz force, Faraday's law and Lenz's law, Maxwell's equations.

Unit 2

Waves and Optics

Huygens' Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Newton's Rings, Michelson interferometer. Fraunhofer diffraction from single slit and circular aperture, Rayleigh criterion for limit of resolution and its application to vision, diffraction gratings and their resolving power. Polarization: Unpolarized, polarized and partially polarized lights, polarization by reflection, double refraction by uniaxial crystals, Polaroid, half wave and quarter wave plates.

Unit 3

Lasers

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (Ruby, Neodymium), dye lasers.

Unit 4

Quantum Mechanics

De Broglie waves, wave functions, wave equation, Schrodinger wave equation: time dependent and time independent form, operators – Eigenfunctions and Eigenvalues, uncertainty principle, particle in a finite potential one -dimensional box, tunnelling effect (Qualitative).

Unit 5

Introduction to Solids

Crystal systems: Miller indices, crystal planes and directions, packing fraction, Classification of solids: Metals, semiconductors, and insulators (qualitative), free electron theory of metals, Fermi level, Density of states, Kronig- Penney model and origin of energy bands.

Textbook

David J Griffiths "Introduction to Electrodynamics", 4th Edition, Pearson, 2015.

Reference Books

1. *Ajay Ghatak, "Optics", 6th Edition, McGraw Hill Education India Private Limited,2017.*
2. *Eugene Hecht, A R Ganesan, "Optics", 4th Edition, Pearson Education, 2008.*
3. *Arthur Beiser, ShobhitMahajan, S. RaiChoudhury"Concepts of Modern Physics", McGraw Hill Education India*
4. *Private Limited, 2017.*
5. *Charles Kittel, "Introduction to Solid State Physics" 8th Edition, Wiley, 2012.*
6. *Halliday, Resnick, Jearl Walker, "Principles of Physics", 10th Edition, Wiley,2015.*

7. John David Jackson, *"Classical Electrodynamics",3rd Edition, Wiley,2007.*
8. *F A Jenkins, H E White, "Fundamental of Optics", 4thEdition,McGraw Hill Education India Private Limited, 2017.*
9. *David J Griffiths, "Introduction to Quantum Mechanics",2nd Edition, PearsonEducation,2015.*
10. *M A Wahab, "Solid State Physics", 3rd Edition, Narosa Publishing House Pvt. Ltd.,2015.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

19CSE100	PROBLEM SOLVING AND ALGORITHMIC THINKING	L-T-P-C: 2-1-3-4

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 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, 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; algorithms vs programs, Problem Understanding and

Analysis – problem definition, input-output, variables, name binding, data organization: lists, arrays etc. algorithms to programs.

Unit 3

Problem solving with algorithms – Searching and Sorting, Evaluating algorithms, modularization, recursion. C for problem solving – Introduction, structure of C programs, data types, data input, output statements, control structures.

Text Book

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

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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS102	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 the engineering concepts and 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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS103	COMPUTER SYSTEM AND HARDWARE 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 as well as maintaining and troubleshooting the basic hardware and software issues.
- It also introduces building a fully functional Linux-based computer using Raspberry Pi and other components.

Course Outcomes

CO1: Understanding the working principles of different computing devices (desktop computers, laptops, etc.).
CO2: Understand PC and laptop hardware components.
CO3: Understand peripheral devices, storage devices, displays and connection interfaces and troubleshoot common hardware issues.
CO4: Understand the procedure for Installation of OS - Linux and supporting, upgrading and troubleshooting OS related issues.
CO5: Understand the concepts of Physical Computing and related use cases.

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, Specialized Expansion Ports: SCSI,

USB, MIDI, Expansion Slots and Boards, PC Cards, Plug and Play, HDMI ports, networking ports. System software: bootstrap module, configuration, OS loading: typical Linux virtual machine. Installing a Linux virtual machine. Using package manager to install/update software. Understanding disk partitions and obtaining partition information using system tools. Obtaining essential system resource utilization and information using system tools and proc file system: disk utilization, memory utilization, process information, CPU utilization.

Unit 2

Operating System: Introduction, Objectives, classification and functions of Operating System, Basics of popular operating system (LINUX, WINDOWS). Kernel prompt, Shell commands. The User Interface: Task Bar, Icons, Menu, Running an Application. Operating System Simple Setting: Changing System Date and Time, Changing Display Properties, To Add or Remove a Windows Component, Changing Mouse Properties, Adding and removing Printers. File and Directory Management: Creating and renaming of files and directories, Common utilities. Interrupts statements in various OS and its uses.

Unit 3

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. Combinational circuit building blocks: Multiplexers - Decoders - Encoders, Sequential circuit building blocks: Flipflops-SR, JK, D and T- Registers - Counters
- 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 Professional;2008.*
10. *Englander, Irv. The Architecture of Computer Hardware, System Software, and Networking. An Information Technology Approach (2009): 11.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

19CUL101	CULTURAL EDUCATION – I	L-T-P-C: 2-0-0-2

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 / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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. BharatiyaVidyaBhavan.*
3. *Awaken Children (Dialogues with Mata Amritanandamayi) Volumes 1 to 9*
4. *My India, India Eternal. Swami Vivekananda. Ramakrishna Mission.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

SEMESTER II

19MAT115	DISCRETE MATHEMATICS	L-T-P-C: 2-0-3-3

Prerequisites: Nil

Course Objectives

- Familiar 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 to solve the recurrence relations.

Course Outcomes

CO1: Understand the basic concepts of Mathematical reasoning and basic counting techniques. Also understand the different types of proves like mathematical induction.
CO2: Understand the concepts of various types of relations, partial ordering and equivalence relations.
CO3: Apply the concepts of generating functions to solve the recurrence relations.
CO4: Apply the concepts of divide and conquer method and principle of inclusion and exclusion to solve some simple algorithms in discrete mathematics.
CO5: Understand various definitions and problems under graphs and trees and study their applications.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	3	2											
CO3	3	3	2											
CO4	3	2	1											
CO5	2	3	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.*
4. *Liu, "Elements of Discrete Mathematics", Tata McGraw- Hill Publishing Company Limited, 2004.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20MAT112	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 theorems in number theory like prime factorization and Fermat's theorems.
- Understand the basic concepts of groups and subgroups and their simple properties.
- Understand the concepts of rings, subrings and quotient rings.
- Apply basic results in Fields in number theory problems.

Course Outcome

CO1: To understand basic definitions in number theory like, prime no.s, GCD and Euclidian algorithm.
CO2: To understand and solve problems in prime factorization theorem, Fermat's theorems and Chine's remainder theorem.
CO3: To understand the basic concepts of groups and subgroups and their simple properties.
CO4: To understand basic concepts of rings, subrings and quotient rings.
CO5: Familiar basic results in Fields and polynomial rings.

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
CO5	3	3	2										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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS111	DIGITAL SIGNAL PROCESSING	L-T-P-C: 2-1-0-3

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 signal processing systems and signal analysis
CO2: To design signal processing systems for specific constraints
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 transform.

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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS112	COMPUTER ORGANIZATION AND ARCHITECTURE	L-T-P-C: 3-0-0-3

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: Design, and Analyze data path for instruction execution using Single Clock Cycle
CO3: Understand design of instruction execution using Multiple Clock Cycles and Analyze / Evaluate the performance of processors.
CO4: Understand Pipelined architecture and Design of 3 and 5 stage pipeline processor in MIPS
CO5: Understand the working of Arithmetic and Logic Unit
CO6: Understanding the concepts of Memory Organization.

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
CO6	2	2											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, Floating Point Arithmetic, Role of performance, RISC and CISC processors.

Unit 2

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. 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. Bus structures–Synchronous and asynchronous - Arbitration - I/O interface circuits – parallel and serial interfaces-Interconnection standards. Modern Processors, Parallel Processing, Secondary storage devices like SSD and flash disk.

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. I/O and memory interfacing using 8085 and 8086: Memory interfacing and I/O interfacing with 8085 and 8086 – Parallel communication interface (8255) –Timer (8253 / 8254) – Keyboard / Display controller (8279) – Interrupt controller (8259) – DMA controller (8257).

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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS113	COMPUTER PROGRAMMING	L-T-P-C: 3-0-0-3

Pre-Requisite(s): 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						
CO2	1	1	1					1						
CO3	1	2	2					2						
CO4	2	3	2					3						

Syllabus

Unit 1

Introduction and 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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS181	COMPUTER PROGRAMMING LAB	L-T-P-C: 0-0-3-1

Pre-Requisite(s): 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						
CO2	1	1	1					1						
CO3	1	2	2					2						
CO4	2	3	2					3						

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, Scope and life time of variables, simple programs using functions, sorting algorithms, comparison between sorting algorithms, Sorting in multidimensional arrays. Sorting in strings. Search problem: Linear search and binary search. Comparison between search procedures. 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: Motivation, examples, declaration, and use. 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, Prentice Hall of India.

Reference(s)

1. *E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.*
2. *Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.*
3. *Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C*
4. *Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language*
5. *Rajaraman V, PHI, Computer Basics and Programming in C*
6. *Yashavant P, Kanetkar, BPB Publications, Let us C*

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)	80	
End Semester		20

*CA – Can be Quizzes, Assignment, Projects, and Reports.

20CYS114	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 protocols, 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, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.

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, 2018

Evaluation Pattern

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

19CUL111	CULTURAL EDUCATION - II	L-T-P-C: 2-0-0-2

Course Objective

- To deepen students' understanding and further their knowledge about the different aspects of Indian culture and heritage.
- To in still 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 Yogasutra-s and their relevance to daily life.
CO4: Familiarize themselves with the inspirational characters and anecdotes from the Mahābhārata and Bhagavad-Gītā 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.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.