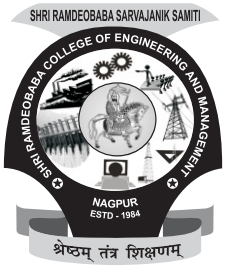

SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2021 – 2022

B.Tech. COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

Published By

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ISO 9001 : 2015 CERTIFIED ORGANISATION

About the Department

The Department of Computer Science & Engineering was established in 2002, is well-equipped with state-of-the-art infrastructure. The state of art infrastructure includes latest configuration desktops organized in four different laboratories. There are total 170 desktops with internet facility and interconnected by a 24 hours server and CISCO router.

The department hosts 300 computers with internet facility. The 24X7 network managed with Cyberoam UTM firewall, and CISCO router offers intranet and internet connectivity. The computer laboratories have high-end servers of IBM and WIPRO along with industry-standard software, viz., Oracle, NetSim, Wireshark, AIX, Robotics Platform, IOT Kit and MSDN. The department promotes high-end computing through Open Source technologies and hosts NVIDIA DGX DL Workstation.

The Department has a distinction of consistently achieving above 95% results in the final year. Students are encouraged to appear in GATE, CAT, GRE and other competitive examinations which have resulted in increasing number of students clearing these exams. Students teams of CSE have emerged winners at the Grand Finale of 2018, 2019 and 2020 editions of Smart India Hackthoan and have been excelling at the world renowned prestigious International Collegiate Programming Contest, ACM ICPC Asia West Regional Contents since 2015.

Department Vision

To continually improve the education environment, in order to develop graduates with strong academic and technical background needed to achieve distinction in the discipline. The excellence is expected in various domains like workforce, higher studies or lifelong learning. To strengthen links between industry through partnership and collaborative development works.

Department Mission

To develop strong foundation of theory and practices of computer science amongst the students to enable them to develop into knowledgeable, responsible professionals, lifelong learners and implement the latest computing technologies for the betterment of the society.

Program Education Objectives

1. To develop the ability to adapt, participate and invent new technologies and systems in the key domains of Computer Science & Engineering and Cyber Security.
2. To produce skilled graduates to identify the security challenges in the real world and suggest suitable design solutions to cater to the industrial needs and excel in innovation and management fields.
3. To inculcate sound Computer Science practices and Cyber security fundamentals among the graduates to meet the dynamically changing technological needs.
4. To imbibe ethical and social responsibility, multidisciplinary team spirit, proficiency in soft skills, entrepreneurship skills and leadership qualities among the students for the betterment of the society.

Programme Outcomes (POs)

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/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 team work: 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 lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

1. The ability to understand and apply the Computer Science and Cyber Security principles.
2. The ability to develop computational knowledge and project development skills using innovative tools and techniques to solve problems in the areas related to Cyber Security.

B. E. Computer Science and Engineering
(Cyber Security)

Semester - I

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	CHT152	Chemistry	3	1	0	4	40	60	100	3 Hrs
2.	CHP152	Chemistry Lab	0	0	3	1.5	25	25	50	-
3.	MAT152	Differential Equation, Linear Algebra, Statistics & Probability	3	0	0	3	40	60	100	3 Hrs
4.	CCT101	Programming for Problem Solving	4	0	0	4	40	60	100	3 Hrs
5.	CCP101	Programming for Problem Solving Lab	0	0	2	1	25	25	50	-
6.	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1	20	30	50	1.5 Hrs
7.	CCT102	Computer Workshop	1	0	0	1	20	30	50	1.5 Hrs
8.	CCP102	Computer Workshop Lab	0	0	2	1	25	25	50	-
9.	HUT151	English	2	0	0	2	40	60	100	3 Hrs.
10.	HUP151	English Lab	0	0	2	1	25	25	50	-
		TOTAL	**14**	**1**	**9**	**19.5**	300	400	**700**	

Semester - II

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PHT154	Introduction to Quantum Computing	3	1	0	4	40	60	100	3 Hrs.
2.	PHP154	Introduction to Quantum Computing Lab	0	0	3	1.5	25	25	50	-
3.	MAT151	Calculus	3	1	0	4	40	60	100	3 Hrs.
4.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	-
5.	CCT103	Digital Electronics	3	0	0	3	40	60	100	3 Hrs.
6.	CCP103	Digital Electronics Lab	0	0	2	1	25	25	50	-
7.	CCT104	Object Oriented Programming	3	0	0	3	40	60	100	3 Hrs.
8.	CCP104	Object Oriented Programming Lab	0	0	2	1	25	25	50	-
9.	HUT152	Constitution of India	2	0	0	0	-	-	-	-
10.	PEP151	Yoga / Sports	0	0	2	0	-	-	-	-
		TOTAL	**14**	**2**	**11**	**18.5**	**260**	**340**	**600**	

Semester-III

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PCC	CCT201	Computer Architecture & Organization	4	0	0	4	40	60	100	3 Hrs
2.	PCC	CCP202	Python Programming lab	0	0	4	2	25	25	50	-
3.	PCC	CCT203	Data Structure & Algorithms	3	1	0	4	40	60	100	3 Hrs
4.	PCC	CCP203	Data Structure & Algorithms Lab	0	0	2	1	25	25	50	-
5.	PCC	CCT204	Computer Networks	3	1	0	4	40	60	100	3 Hrs
6.	PCC	CCP204	Computer Networks Lab	0	0	2	1	25	25	50	-
7.	BSC	MAT273	Mathematics for Cyber Security	2	1	0	3	40	60	100	3 Hrs
8.	HSSM	HUT253	Business Communication	3	0	0	3	40	60	100	3 Hrs
			TOTAL	**15**	**3**	**8**	**22**	**275**	**375**	**650**	

Semester-IV

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BSC	MAT262	Probability and Queuing Theory	3	1	0	4	40	60	100	3 Hrs
2.	PCC	CCT205	Operating Systems	3	0	0	3	40	60	100	3 Hrs
3.	PCC	CCP205	Operating Systems Lab	0	0	2	1	25	25	50	-
4.	PCC	CCT206	Design & Analysis of Algorithms	3	0	0	3	40	60	100	3Hrs
5.	PCC	CCP206	Design & Analysis of Algorithms Lab	0	0	2	1	25	25	50	-
6.	PCC	CCT207	Theory of Computation	3	0	0	3	40	60	100	3 Hrs
7.	PCC	CCT208	Crytography	3	0	0	3	40	60	100	3 Hrs
8.	PCC	CCP208	Crytography Lab	0	0	2	1	25	25	50	-
9.	OEC		Open Elective-I/MOOC	3	0	0	3	40	60	100	3 Hrs
10.	BSC	CHT252	Environmental Sciences	2	-	-	0	-	-	-	-
			TOTAL	**20**	**1**	**6**	**22**	**315**	**435**	**750**	

Semester-V

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PCC	CCT301	Software Engineering and Project Management	3	0	0	3	40	60	100	3 Hrs
2.	PCC	CCP301	Software Engineering and Project Management Lab	0	0	2	1	25	25	50	-
3.	PCC	CCT302	Computer Security	3	1	0	4	40	60	100	3 Hrs
4.	PCC	CCP302	Computer Security Lab	0	0	2	1	25	25	50	-
5.	PCC	CCT303	Artificial Intelligence and Cyber Security	3	0	0	3	40	60	100	3 Hrs
6.	PEC	CCT304	Elective - I	3	0	0	3	40	60	100	3 Hrs
7.	OEC		**Open Elective - II**	3	0	0	3	40	60	100	3 Hrs
8.	PCC	CCP303	Artificial Intelligence and Cyber Security Lab	0	0	2	1	25	25	50	3 Hrs
9.	MC	HUT353	Indian Traditional Knowledge	2	-	-	0	-	-	-	-
10.	PR	CCP305	Mini Project - 1	-	-	4	2	25	25	50	-
			TOTAL	**17**	**1**	**10**	**21**	**275**	**375**	**650**	

Course Code	ELECTIVE – I
CCT304-1	Basics of Ethical Hacking
CCT304-2	Network & Web Security, Firewalls and VPNs
CCT304-3	Security Policies and implementation

Semester-VI

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PCC	CCT306	Introduction to Cloud Security	3	0	0	3	40	60	100	3 Hrs
2.	PCC	CCP306	Introduction to Cloud Security Lab	0	0	2	1	25	25	50	-
3.	PCC	CCT307	Database Management System	3	0	0	3	40	60	100	3 Hrs
4.	PCC	CCP307	Database Management System Lab	0	0	2	1	25	25	50	-
5.	PCC	CCT308	Complier Design	3	0	0	3	40	60	100	3 Hrs
6.	PCC	CCP308	Complier Design Lab	0	0	2	1	25	25	50	-
7.	PEC	CCT309	Elective-II	3	0	0	3	40	60	100	3 Hrs
8.	PEC	CCT310	Elective-III	3	0	0	3	40	60	100	3 Hrs
9.	OEC		Open Elective-III	3	0	0	3	40	60	100	3 Hrs
10.	PR	CCP311	Mini Project-2	0	0	4	2	25	25	50	-
			TOTAL	**18**	**0**	**10**	**23**	**340**	**460**	**800**	

Course Code	ELECTIVE – II	Course Code	ELECTIVE – III
CCT309-1	Wireless & Mobile Device Security	CCT310-1	Managing Risk in Information Systems
CCT309-2	Incident Handling and Response	CCT310-2	IoT Security
CCT309-3	Security Strategies in Windows and Linux	CCT310-3	Application Security
CCT309-4	Security in Distributed Computing	CCT310-4	Threat and Malware Analysis

Semester-VII

Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PEC	CCT401	Elective-IV	3	0	0	3	40	60	100	3 Hrs
2.	PEC	CCP401	Elective-IV Lab	0	0	2	1	25	25	50	-
3.	PEC	CCT402	Elective-V	3	0	0	3	40	60	100	3 Hrs
4.	PEC	CCP402	Elective-V Lab	0	0	2	1	25	25	50	-
5.	OEC		Open Elective-IV	3	0	0	3	40	60	100	3 Hrs
6.	BSC	IDT451	Bio-informatics	2	0	0	2	20	30	50	1.5hr
7.	PCC	CCT403	Secure Coding	2	1	0	3	40	60	100	3 Hrs
8.	PR	CCP404	Project Phase – I	0	0	12	6	50	50	100	-
			TOTAL	**13**	**1**	**16**	**22**	**280**	**370**	**650**	

Course Code	ELECTIVE – IV	Course Code	ELECTIVE – V
CCT401-1	Database and Email Forensics	CCT402-1	Intrusion Detection and Prevention System
CCT401-2	Auditing IT Infrastructure for Compliance	CCT402-2	Cyber Law and Legal Issues in Cyber Security
CCT401-3	Blockchain Security	CCT402-3	Privacy Engineering

Semester-VIII

Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PEC	CCT405	Elective VI	3	0	0	3	40	60	100	3 Hrs
2.	PEC	CCT406	Elective VII	3	0	0	3	40	60	100	3 Hrs
3.	PR	CCP407	Project Phase – 2	0	0	12	6	50	50	100	-
			TOTAL	**6**	**0**	**12**		**130**	**170**	**300**	
			OR								
1.	PR	CCP408	Industry Internship (one Semester)	0	0	12	12	150	150	300	-
				0	**0**	**0**	**12**	**150**	**150**	**300**	

Course Code	ELECTIVE – VI	Course Code	ELECTIVE – VII
CCT405-1	Vulnerability Assessment and Penetration Testing	CCT406-1	Advanced Mobile Forensics and Security
CCT405-2	Database Security	CCT406-2	Executive Governance and Management in IT Security
CCT405-3	Disaster Recovery and Business continuity Management	CCT406-3	Security in Social Networks
CCT405-4	Testing Cyber Crime Investigation and Digital Forensics	CCT406-4	Security of Embedded Systems

Open Elective - I	Professional Ethics
Open Elective - II	Mobile application Development
Open Elective - III	IT Infrastructure Management
Open Elective - IV	Security basics and Cyber Security

Total Credits (I Sem to VIII Sem): 160

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CHT152 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P: 0 Hr, Per Week **Total Credits : 4**

Course Outcomes

After the successful completion of the course, students shall be able to

- Predict the properties and interactions of chemical substances by understanding their composition at the atomic level. [CO for Unit – 1]
- Conversant in applying unique properties of nano-materials to solve challenges in our life. [CO for Unit – 2]
- Explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing. [CO for Unit – 3]
- Study chemical kinetics using concepts of computational chemistry. [CO for Unit – 4]
- Discuss how spectroscopic methods are used for qualitative and quantitative analyses. [CO for Unit – 5]
- Analyse impurities present in the water and suggest the methodology for its removal. [CO for Unit – 6]

Syllabus

Unit 1: Solid State Chemistry (7 Hours)

Bondings in atoms: Primary bonding: ionic, covalent, metallic. Secondary bonding: dipole-dipole, induced dipole-induced dipole, London dispersion/van der Waals, hydrogen. Shapes of molecules: hybridization, LCAO-MO, VSEPR theory.

Electronic material: Band theory: metals, insulators, and semiconductors. Band gaps, doping. Silicon wafer production.

Unit 2: Nano-material-I(7 Hours)

Basics of Nanochemistry: Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challengs of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical properties.

Application of Nanomaterial: Molecular electronics and nanoelectronics, Nanotechnology for waste reduction and improved energy efficiency, Carbon Nanotubes for energy storage, Hydrogen Storage in Carbon Nanotubes, nanotechnology based water treatment strategies.

Unit 3: Advanced Materials: (7 hours)

Composite materials: Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber- Reinforced Composites and Applications.

Reinforcements: Fibres- Glass, Kevlar, Carbon, Silicon Carbide, And Born Carbide Fibres.

Industrial Polymer: Thermoplastics, Thermosetting Plastics, Polymers used in electronic industries, Piezo and pyroelectric polymers, Polymers in optical media data storage devices.

Unit 4: Computational Chemistry [6 Hours]

Rate of the reaction, Order and Molecularity of the reaction, Rate expression for Zero Order, First Order and Second Order Reactions, Effect of the temperature, Use of Mathematica for determining rate of the reaction, etc.

Unit 5: Material Characterization using different Spectroscopic Techniques [7 Hours]

Fundamentals of spectroscopy, Infrared Spectroscopy, Electronic Spectrocopy, Nuclear Magnetic Resonance Spectroscopy.

Fundamentals of X-Ray Diffractions (XRD), X-Ray Fluorescence (XRF) spectroscopy.

Unit 6: Water Technology [8 Hours]

Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion-exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosis.

Text Books

1. J. Michael Hollas, Modern Spectroscopy, Fourth Edition, John Wiley and Sons, 2004.
2. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
3. Bradley D. Fahlman, Materials Chemistry, Third Edition, Springer Nature, 2018.
4. Brian W. Pfennig, Principles of Inorganic Chemistry, John Wiley and Sons, 2015.
5. Steven S. Zumdahl, Donald J. DeCoste, Chemical Principles,Eighth Edition, Cengage Learning, 2017.
6. Catherine E. Housecroft and Edwin C. Constable, Chemistry: An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition, Pearson Education Limited, 2006.
7. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Fifth Edition, John Wiley and Sons, 2006.
8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James R. Vyvyan, Introduction to Spectroscopy, Fifth Edition, Cengage Learning, 2009.
9. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004.
10. P. C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publication.
11. S. S. Dara, A Textbook ofEngineering Chemistry, S. Chand Publications.
12. J. D. Lee, Concise Inorganic Chemistry, Fourth Edition, Chapman and Hall Publications.

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CHP152 **Course : Chemistry Lab**

L: 0 Hrs, T: 0 Hr, P: 3 Hr, Per Week **Total Credits : 1.5**

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

- Estimate the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.
- Use principle of spectroscopic techniques for structural determination.

List of Experiments: [Any Eight from the List]

[1] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.

[2] To find out types of alkalinity and estimation of their extent in the water sample.

[3] Estimation of temporary, permanent and total hardness present in the water sample using complexometric titration method.

[4] Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.

[5] Determination of rate of the reaction of hydrolysis of ethyl acetate at room temperature and analysis of experimental data using Computational Software.

[6] To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find out order of the reaction and analysis of experimental data using Computational Software.

[7] Synthesis of Nano-material/Polymer and its study.

[8] Determination of relative and kinematic viscosities of aqueous solutions of Poly-ethylene glycol (Polymeric Liquid) using Redwood Viscometer (type I or II) at different temperatures.

[9] To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non-electrolyte solute (Soap) in the solution through Surface Tension Determination.

[10] Study of ion-exchange column for removal of hardness in the water sample.

[11] Demonstrations of organic spectral techniques: IR, NMR.

[12] Demonstration of in-organic spectral techniques: XRD, XRF.

Text Books/Reference Books

(1) S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.

(2) J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.

(3) A. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.

(4) V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.

(5) Ashutosh Kar , Advanced Practical Medicinal Chemistry, New Age International Publisher.

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : MAT152 **Course : Differential Equations, Linear Algebra, Statistics & Probability**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equation, statistics, probability and Matrices. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1: First order ordinary differential equations (7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3: Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning

Application of Differential Equations.

Textbooks / References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics: 2nd ed: J. R. Spiegal, Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT101 **Course : Programming for Problem Solving**

L: 4 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 4**

Course Outcomes

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

Text Books

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP101 **Course : Programming for Problem Solving Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Outcomes

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code: IDT151 **Course: Creativity, Innovation & Design Thinking**

L: 1 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 1**

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

UNIT I. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking: Thinking differently, Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brain writing, The SCAMPER methods, Metaphoric thinking, Outrageous thinking, Mapping thoughts, other (new approaches)

UNIT 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, six thinking hats, Ethical considerations

UNIT 5. Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

UNIT 6.Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Book:

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large group's hands-on projects
- Eight-dimensional (8D) ideation method examples Large teams videos

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT102 **Course : Computer Workshop**

L: 1 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 1**

Course Objectives

1. Understand the definition and principles of UI/UX Design in order to design with intention.
2. Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
3. Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
4. Discover the industry-standard tools and specific project deliverables in UI/UX.
5. Explain why you made design decisions, through presentations of assignments and your personal portfolio.

Unit 1:

UI/UX Overview: Intro to UI/UX, Notion & Figma Setup, Design Thinking.

User Research: How to identify stakeholders, Figma Basics, How to identify user needs.

Unit 2:

User Journeys: Mapping the user journey, Figma Grayscales, Finding solutions & constraint cards, Grayscales & User Testing: UX Principles, Figma Prototype, Understanding user testing.

Unit 3:

UI Principles: UI Principles, Color and Font.

Style Guide: Components, Responsive Design.

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand basics of UI/UX
2. Find solutions and constraint cards.
3. Design responsive UI.

Text Books

1. UI/UX design for designer and developers: by Nathan Clark
2. User Story mapping software for agile age [Paid subscription on yearly basis]
3. User story mapping by Jeff Patton, O'Reilly Publication

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP102 **Course : Computer Workshop Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

Throughout the course, students will be expected to learn following concept:

1. Understand UI/UX basics and its use in software industry
2. Understand basic use cases of UI/UX.
3. Develop small utilities using UI/UX tools
4. Develop and integrate UI/UX with basic programs

Syllabus

Programs based on:

1. Illustration tool box
2. Storytelling and typography tools
3. UX writing and AR/VR tools
4. Voice technology tools
5. Motion Design, Animated graphics

Course Outcomes

On successful completion of the course, students will be able to:

1. Design UI/UX use cases using Illustration tool box
2. Design and use storytelling and typography for requirement specification.
3. Use UX writing, AR and VR models to develop interfaces for use cases
4. Develop small applications using voice technology, motion design, and animation.

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : HUT151 **Course : English**

L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 2**

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Redundancies

3.6 Cliches

4. Nature and Style of sensible Writing

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

5. Writing Practices

5.1 Comprehension

5.2 Precise Writing

5.3 Essay Writing

5.4 Letter Writing

5.5 Email Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for Semester I, BE Computer Science & Engineering (Cyber Security)

Course Code : HUP151 **Course : English Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation, Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations: Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : PHT154 **Course : Introduction to Quantum Computing**

L: 3 Hrs, T: 1 Hr, P: 0Hr, Per Week **Total Credits : 4**

Course Objectives

1. To introduce the fundamentals of quantum computing to students
2. The problem solving approach using finite dimensional mathematics

Course Outcomes

After successful completion of the course, the students will learn,

1. Basics of complex vector spaces
2. Quantum mechanics as applied in Quantum computing
3. Architecture and algorithms
4. Fundamentals of Quantum computations

Module 1: Complex Vector Spaces

Algebra and Geometry of Complex numbers, Real and Complex Vector Spaces, definitions, properties, basis and dimensions, Generalization to n-dimensional space

Module 2: Linear Algebra

Inner products, Hilbert Spaces, Eigenvalues and Eigenvectors, Hermitian and Unitary Matrices, Tensor Product, Applications of linear algebra in computer graphics, Geometric transforms, positioning the virtual camera

Module 3: Basic Quantum Theory

Introduction to Quantum mechanics, Schrodinger's time dependent equation, Wave nature of Particles, expectation values, variance, standard deviation, probability density, Stationary states, Infinite square well, Uncertainty principle

Module 4: Classical and Quantum Systems

Deterministic and Probabilistic Systems, Quantum Systems, Observations, Quantum measurement principles, Stochastic matrices, Probabilistic double slit experiment with photons, Entangled states, Quantum clocks

Module 5: Architecture

Bits and Qubits, Classical Gates, Reversible Gates, Quantum Gates, Toffoli and Fradkin Gates, Bloch Sphere, Deusch Gate, No-cloning theorem, Applications in Cryptography and Quantum teleportation

Module 6: Quantum algorithms

Deutsch's algorithm, The Deutsch-Jozsa algorithm, Simon's periodicity algorithm, Grover's search algorithm, Shor's factoring algorithm, Quantum Fourier Transform

Text Book

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
2. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

Reference Books

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008
2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : PHP154 **Course: Introduction to Quantum Computing Lab**

L: 0 Hrs, T: 0 Hr, P: 3Hr, Per Week **Total Credits : 1.5**

Course Outcomes

The physics laboratory will consist of experiments and programming exercises illustrating the principles of physics relevant to the study of computer science and engineering. During the training in the Physics Lab, the students will be able,

1. To develop skills for experimental verification of physics laws
2. To analyze the results using the mathematical tools
3. To learn the computational techniques
4. To write the project reports

The laboratory will consist of general physics experiments and computational physics practicals

General Physics

1. Measuring scales and error estimation
2. Verification of Ohm's law and linear least square fitting method
3. Verification of Newton's law of cooling
4. Simple harmonic motion
5. Magnetic flux measurement using the graphical method of integration
6. Measurement, analysis and fitting of non-linear IV characteristics of PN junction diode

Python based Computational Physics

1. Introduction to Python programming, Environment, Syntax and Data Structures
2. Linear least square fit method for data analysis
3. Plotting of Plank's function and verification of Stefan's law
4. Finding inverse, norm and inner products, rank of a matrix
5. Introduction to quantum computing packages (GitHub repository)
6. Implementation of Deutsch-Josza algorithm using Cirq library

Project

A python based project on the applications of linear algebra, quantum mechanics or quantum computing to solve science and engineering problems.

Reference Books

1. Lab manual prepared by Physics Department, RCOEM, Nagpur
2. Introduction to Python for science and engineering, David Pine, CRC Press 2018

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : MAT151 **Course : Calculus**

L: 3 Hrs, T: 1 Hr, P: 0 Hr, Per Week **Total Credits : 4**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module - I : Differential Calculus: (12hours)

Taylor's and Maclaurin's series expansions; radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module - II : Integral Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module - IV : Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module - V : Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module - VI : Vector Calculus (10 hours)

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes and their applications.

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : MAP151 **Course: Computational Mathematics Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions.

At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department,RCOEM.
2. A minimum of 8 experiments to be performed based on the above list.

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT103 **Course : Digital Electronics**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Outcomes

After successful completion of this course, the student will be able to,

1. Understanding of various optimization techniques used to minimize and design digital circuits.
2. Analyze and design various combinational logic circuits.
3. Analyze and design various sequential circuits.
4. Design different microprocessor based components of computer system using combinational and sequential circuits.

Course Contents

UNIT-I: Basics of Digital Electronics

Motivation for digital systems: Logic and Boolean algebra, Number Systems. Logic Gates & Truth Tables, Demorgan's law, Minimization of combinational circuits using Karnaugh maps up to five variable. Map manipulation-essential prime implicants, non-essential prime implicants.

UNIT-II: Combinational Circuit Design

Design procedure: Multiplexers, Demultiplexer, Encoders, Decoders, Code Converters, Adders, Subtractor (Half, Full), BCD Adder/ Subtractor, ripple and carry look-ahead addition.

UNIT-III: Sequential circuit Design-I

Storage elements, Flip-flops and latches: D, T, J/K, S/R flip-flops. Master Slave Conversion of one of type of F/F to another Sequential circuit. Analysis –Input equations, state table, and analysis with J-K Flip flops. Sequential circuit Design, Design procedure, designing with D & J-K Flip flop.

UNIT-IV: Sequential circuit Design-II

Counters, asynchronous and synchronous design using state and excitation tables. Registers & Shift registers.

UNIT-V: Programmable logic Design

Memory & Programmable logic Devices: RAM, Array of RAM IC's, Read only Memory, PLA, PAL, Flash Memories

UNIT-VI: Fundamental of Microprocessor

Introduction to μp 8085, Addressing modes, Instruction set, Programming of μp 8085.

Text Books

1. Morris Mano; Digital Logic Design; Fourth edition, McGraw Hill
2. R.P.Jain; Modern Digital Electronic; Fourth edition; Tata McGraw-Hill.
3. V.J.Vibhute; 8-Bit Microprocessor & Microcontrollers; fifth edition.

Reference books

1. A. Anand Kumar; Fundamental of Digital Electronics; Second Edition, PHI
2. A.P.Godse; Digital circuit & design; Technical Publications; 2009.
3. Ramesh Gaonkar; 8 bit Microprocessor; CBS Publishers; 2011.

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP103 **Course : Digital Electronics Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Outcome

On Successful completion of course, students will be able to:

1. Use logic gates for designing digital circuits
2. Implement combinational circuits using VHDL
3. Implement sequential circuits using VHDL
4. Apply the knowledge gained for their project work based on the hardware digital circuits

Practicals based on above theory syllabus

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT104 **Course : Object Oriented Programming**

L: 3Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

1. To make students understand Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
2. Introduce students with fundamental concepts like exception handling, generics, multithreading and streams.

SYLLABUS

UNIT I

Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding.Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading.

UNIT II

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

UNIT III

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, Introduction to streams, byte streams, character streams, file handling in Java, Serialization.

UNIT IV

Generics, generic class with two type parameter, bounded generics. Collection classes: Arraylist, LinkedList, Hashset, Treeset .

UNIT V

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, InterThread communications.

UNIT VI

Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioral Patterns.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Understand the principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Understand concept of generics and implement collection classes. Use exception handling mechanism.
3. Efficiently work with streams, use multithreading for solving classic synchronization problems. Perform java database connectivity and execute basic SQL commands.
4. Understand characteristics and need of Design Pattern in Software Design Process.

Text Books

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. Design Patterns By Erich Gamma, Pearson Education.

Reference Books

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press 2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw- Hill Education Private Ltd 2013.

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP104 **Course : Object Oriented Programming Lab**

L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

1. To develop ability of students to implement basic concepts and techniques of object oriented programming paradigm like encapsulation, inheritance, polymorphism, exception handling.
2. Develop solution to problems using collection classes, generics, streams, multithreading.

SYLLABUS

Experiments based on above Syllabus.

Course Outcomes

On completion of the course the student will be able to

1. Design solution to problems using concepts of object oriented programming like classes, objects, inheritance with proper exception handling.
2. Use collection classes, generic classes to design programs and perform database connectivity.
3. Implement programs based on streams and multithreading.

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : HUT152 **Course : Constitution of India**

L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social Justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

Syllabus for Semester II, BE Computer Science & Engineering (Cyber Security)

Course Code : PEP151 **Course: Yoga / Sports**

L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 0**

Course outcome

On successful completion of the course, students will be able to:_

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline

Sports

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

Yoga : Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.

Physical Efficiency Tests : This includes 6 health related physical fitness tests.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT201 **Course: Computer Architecture and Organization**

L: 4Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 4**

Course Objectives

1. To impart to students the basic structure of Computers and different data representation techniques
2. To familiarize students with designing of memory hierarchy and control unit
3. To make students aware of I/O organization

Syllabus

Unit - I : Basic Structure Of Computers

Functional units of computer. Instructions set architecture of a CPU Instruction sequencing, Addressing modes, instruction set classification, subroutine & parameter passing, expanding opcode

Unit - II : Basic Processing Unit

Bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro-programmed Control.

Unit - III : Data Representation

signed number representations and their operations, Computer arithmetic – integer addition and subtraction, design of Fast Adders, Multiplication- shift and add, booth's Algorithm, bit-pair recoding, Integer Division- restoring and non-restoring division. Floating point numbers-representation, arithmetic, guard bits and rounding.

Unit - IV : Memory System Design

Semiconductor RAM memories, ROM, higher order memory design, multi-module memories, Secondary storage – Magnetic disk, Optical disk.

Unit - V : Memory Organization

Memory interleaving, concept of hierarchical memory, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policy, Virtual Memory. Pipelining : Basic concepts of pipelining, throughput and speedup.

Unit - VI : Input/Output Organization

I/O mapped I/O and memory mapped I/O, interrupts and interrupt handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Direct Memory AccessCourse Outcomes:

On Successful completion of course, students will be able to:

1. Understand the basic components of a computer, including CPU, memories, and input/output, and their organization.
2. Understand the cost performance tradeoff in designing memory hierarchy and instruction sets.
3. Understand the execution of complete instruction and design of control unit.
4. Perform mathematical operations on arithmetic and floating point numbers.

Text Books

1. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky; Computer Organisation; 5th edition; Tata McGraw Hill, 2002.
2. W. Stallings; Computer Organization & Architecture; PHI publication; 2001.
3. J. P. Hayes; Computer Architecture & Organization; 3rd edition; McGraw-Hill; 1998.

Reference Books

1. M Mano; Computer System and Architecture; PHI publication; 1993.
2. A.S.Tanenbaum; Structured Computer Organization; Prentice Hall of India Ltd.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP202 **Course: Python Programming Lab**

L: 0Hrs, T: 0 Hr, P: 4Hr, Per Week **Total Credits : 2**

Course Objectives

The course focuses on developing the python programming skills to do a variety of programming tasks where the students are encouraged to develop application using python. Apart from the basic constructs of python programming, data structures, object oriented programming, exception handling is covered. The course also targets the coverage of important modules and libraries available in python.

Syllabus

- Arithmetic, logical operations, Control statements, Functions, Class and OOM
- String, List, Array, Tuples, Dictionary, Set
- Collections, Files, Exception Handling
- Module, Packages, Library
- Plotting, Web scrapping, Multimedia services
- Matplotlib, Pandas, Request, Numpy
- Beautifil soup, Pyglet, Scrapy, PyGame
- Pywin32, PyGTK, Geopy

Course Outcomes

On completion of the course the student will be able to

1) Understand the usage of various instructions, functions, modules, packages and libraries in python programming
2) Code, debug and execute python program to solve given problem
3) Select an appropriate instruction, function, module and library for writing an efficient and correct code in Python
4) Design a small python-based software to solve a numerical, multimedia, games, location, web-based problems.

Reference Books

1. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
3. David M.Baezly "Python Essential Reference". Addison-Wesley Professional; Fourth Edition, 2009.
4. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition, 2013.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT203 **Course: Data Structure and Algorithms**

L: 3Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits : 4**

Course Objectives

1. To impart to students the basic concepts of data structures and algorithms.
2. To familiarize students on different searching and sorting techniques.
3. To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
4. To enable students to devise algorithms for solving real-world problems.

Syllabus

UNIT I Data Structures and Algorithms Basics

- Introduction: basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics.
- Algorithms: definition, characteristics, analysis of an algorithm, asymptotic notations, time and space tradeoffs.
- Array ADT: definition, operations and representations – row-major and column- major.

UNIT II Stacks and Queues

- Stack ADT: allowable operations, algorithms and their complexity analysis, applications of stacks – expression conversion and evaluation (algorithmic analysis), multiple stacks.
- Queue ADT: allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.

UNIT III Linked Lists

- Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc.
- Doubly and Circular Linked Lists: operations and algorithmic analysis. Linked representation of stacks and queues, header node linked lists.

UNIT IV Sorting and Searching

- Sorting: different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison.
- Searching: necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods.UNIT V Trees

- Trees: basic tree terminologies, binary tree and operations, binary search tree [BST] and operations with time analysis of algorithms, threaded binary trees.
- Self-balancing Search Trees: tree rotations, AVL tree and operations, B+-tree: definitions, characteristics, and operations (introductory).

UNIT VI Graphs and Hashing

- Graphs: basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms.
- Hashing: hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques.

Course Outcomes

On completion of the course the student will be able to

1. Recognize different ADTs and their operations and specify their complexities.
2. Design and realize linear data structures (stacks, queues, linked lists) and analyze their computation complexity.
3. Devise different sorting (comparison based, divide-and-conquer, distributive, and tree-based) and searching (linear, binary) methods and analyze their time and space requirements.
4. Design traversal and path finding algorithms for Trees and Graphs.

Text Books

1. Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.
3. G.A.V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; First Edition; McGraw Hill; 2008.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein; Introduction to Algorithms; Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. A. K. Sharma; Data Structures using C, Second Edition, Pearson Education, 2013.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP203 **Course: Data Structure and Algorithms Lab**

L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

1. To enable students to employ different searching and sorting methods.
2. To prepare students to identify and apply linear (stacks, queues, linked lists) and non- linear (trees, graphs) data structures in solving problems.
3. To encourage students to design and execute tree-based algorithms for solving real- world problems.

Syllabus

Experiments based on CCT203 Syllabus in C | C++.

Course Outcomes

On completion of the course the student will be able to

1. Design and realize different linear data structures.
2. Identify and apply specific methods of searching and sorting to solve a problem.
3. Implement and analyze operations on binary search trees and AVL trees.
4. Implement graph traversal algorithms, find shortest paths and analyze them.

Reference Books

1. K R. Venugopal and Sudeep. R Prasad; Mastering C; Second Edition; McGraw Hill; 2015.
2. Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
3. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT204 **Course : Computer Network**

L: 3Hrs, T: 1Hr, P: 0Hr, Per Week **Total Credits : 4**

Course Objectives

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. To provide an opportunity to do network programming

Syllabus

UNIT - I

- Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division

UNIT - II

- Data Link Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ.

UNIT - III

- Medium Access Sub Layer: Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE 802 standard protocols.

UNIT - IV

- Network Layer: Internet Protocol (IP) – Logical Addressing: IPV4, IPV6; Address mapping: ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT V

- Transport Layer: Elements of Transport protocols: Addressing, Connection establishment,
- Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol
- (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and
- Token Bucket algorithm.

UNIT VI

- Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand basics of computer networks and reference models
2. Identify the Design issues of each layer of OSI model
3. Implement the protocols of OSI model

Text Books

1. Computer Networks: 5th ed by Andrew. S. Tanenbaum. PHI Publication.
2. Data Communications and Networks: 3rd ed by Behrouz A. Forouzan. Tata McGraw Hill Publication.

Reference Books

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition.
2. William Stallings, "Data and Computer Communications", PHI 6th Edition

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP204 **Course : Computer Network Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

1. To introduce use of different network simulation software.
2. To analyze performance of different protocols at various layers of a network architecture.
3. To demonstrate the implementation of various networking concepts.

Syllabus

Experiments based on CCT204 Syllabus.

Course Outcomes

On successful completion of the course, students will be able to:

1. Simulate and then configure different types of networks.
2. Implement algorithms present in different layers of OSI model
3. Implement networking concepts like server, client and addressing mechanism.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : MAT273 **Course : Mathematics for Cyber Security**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

1. Introduce basic concepts and knowledge in number theory, together with a wide variety of interesting applications of discrete mathematics.
2. Train students to solve problems from algorithm design and analysis, coding theory etc. and to apply techniques of number theory in cryptography.

Syllabus

Module - I : (10 Lectures)

Introduction : Divisibility, Greatest common divisor, Prime numbers, Fundamental theorem of arithmetic, Fermat numbers, Euclidean algorithm, Fermat's theorem, Euler totient function, Euler's theorem.

Module - II : (10 Lectures)

Congruences: Definition, Basic properties of congruences ,Chinese remainder theorem, Quadratic Residues.

Module - III : (10 Lectures)

Euler's formula and roots modulo pq with its application, Discrete Logarithms and the Discrete Log Problem, Pollard's -Algorithm, Primality Testing-Sieving Methods, Fermat's Primality Testing, Pseudoprimes and Probabilistic Primality Testing.

Module - IV : (10 Lectures)

Groups, Subgroup, Cyclic groups, group homomorphisms, Permutation groups, Cosets, Field , Finite field, Factorization of polynomials over a field, Elliptic curves, Elliptic curves over finite field.

Course Outcomes

On successful completion of the course, student shall be able to

1. Understand concept of number Theory and its application to Cyber Security.
2. Understand the ideas of group, ring and an integral domain and apply these structures in coding and cryptography.
3. Understand the significance of elliptic curves and finite fields to the modern world and the internet.

Text Books

1. Ivan Niven, Herbert S. Zuckerman, and Hugh L. Montgomery, 'An introduction to the theory of numbers', John Wiley and Sons 2004.
2. David M Burton, 'Elementary Number Theory' , McGraw Hill, Seventh edition 2014.
3. Fraleigh J. B., 'A first course in abstract algebra', Narosa, 1990.

Reference Books

1. Wade Trappe, Lawrence C. Washington, 'Introduction to Cryptography with Coding Theory', Pearson Education International 2012.
2. Baumslag, Fine, Kreuzer, Rosenberger., 'A Course in Mathematical cryptography', De Gruyter Graduate, 2015.

Syllabus for Semester III, BE Computer Science & Engineering (Cyber Security)

Course Code : HUT253 **Course : Business Communication**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

The course aims to develop the skills of students of writing effective business documents and applying effective strategies of verbal business communication

Syllabus

On completion of the course, students will be able to achieve the following:

CO1: Understand the fundamentals and objectives of business communication, and role of audience in effective communication.

CO2: Develop technical writing skills and produce effective workplace documents.

CO3: Apply the rules of English grammar in writing.

CO4: Develop skills to enhance visual appeal of documents.

CO5: Evaluate and apply strategies for effective oral communication for professional needs.

Course Outcomes

Unit - I : Fundamentals of Business Communication

Definition of communication and business communication, Objectives of Business Communication, Audience recognition, Barriers of Communication, Product Promotion, Usage of Social Media, Negotiation Skills, Persuasive Communication, PAC concept

Unit - II : Technical Writing

Process of Technical Writing, Letters: Job application, Job Description and Resume, enquiry, complaint, order, follow-up, cover/transmittal letters, Sales Letters, and e- mails. Other Forms of Technical Writing: Organizational announcements, Notices, Agenda, Minutes of Meeting, Memorandums.

Unit - III : Grammar for Writing

Punctuations, Mechanics, Active/ Passive, Transformation of Sentences, Subject-Verb Agreement, Articles, Prepositions

Unit - IV : Business Reports

Basic formats and types - Annual, Progress, Project (Project Charter, Project Timeline), Market Search, Sales, Feasibility/Recommendation, Case Study evaluation.

Unit - V: Preparation of Documents

Visual Appeal: Document Design, Graphics, Tables, User Manuals, Brochures, Fliers

Unit - VI : Effective Oral Communication

Non- Verbal Communication, Presentation and Public speaking, Group Discussion

Text Books

1. Sharon Gerson, Steven Gerson, "Technical Communication: Process and Product", 2018, Pearson
2. Sanjay Kumar, Pushpa Lata, Communication Skills, 2nd Edition, Oxford Publication, 2018.
3. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
4. P.D. Chaturvedi and Mukesh Chaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.
5. William Strunk Jr. and E.B. White The Elements of Style, Allyn & Bacon 'A Pearson Education Company', 2000.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : MAT262 **Course : Probability and Queuing Theory**

L: 4Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 4**

Course Objectives

1. Acquire skills in handling situations involving several random variables and functions of random variables.
2. Understand and characterize phenomena which evolve with respect to time in a probabilistic manner.
3. Be exposed to basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

Syllabus

Module - I : (10 Lectures)

Review of Discrete and continuous random variable, joint probability function, Marginal and Conditional distribution, Mean , Variance, Covariance of two dimensional random variables.

Module - II :(12 Lectures)

Introduction to stochastic process, Poisson process, random walk, stationary process, transition probability matrix, transition diagram , Markov chain, birth and death process, limiting distributions.

Module - III : (12Lectures)

Modelling of queuing systems, queuing systems with losses, queuing systems allowing waiting time.

Module - IV : (12 Lectures)

Markovian Models: Single server queues(M/M/1), Multi-server Queues(M/M/C), Finite Source model M/G/1 (steady state solution only), PollaczekKhintchine formula, Queues with unlimited service(M/M/∞).

Course Outcomes

On successful completion of the course, student shall be able to

1. Apply the concepts of multiple random variables to Engineering Problems.
2. Understand and compute quantitative metrics of performance for queuing systems

Apply and extend queuing models to analyze real world systems.

Text Books

1. Medhi J., "Stochastic Processes", New Age Publishers, New Delhi, 1994.
2. T. Veerarajan, "Probability, Statistics and Random process", Tata McGraw Hill, Second Edition, New Delhi, 2003 .
3. Kishore S. Trivedi, '' Probability and statistics with reliability, Queuing and computer science application, PHI private Ltd, 2009.

Reference Books

1. Gross, D. and Harris, C.M., "Fundamentals of Queuing theory", John Wiley 2014.
2. Ross, S., "A first course in probability", Pearson Education, Sixth Edition, Delhi, 2002
3. Allen., A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi, 1981.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT205 **Course : Operating System**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

1. The course focuses on developing a fundamental knowledge of operating systems.
2. The course targets at the detail understanding of the basic tasks such as scheduling, memory management and File systems
3. It also covers the complex concepts of inter process communication and deadlocks.

Syllabus

Unit - I

Introduction : Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine, Case study on LINUX and Windows Operating System.

Unit - II

Processes : Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Threads : Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling : Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SRTF, Priority, RR, Case study on Process Management in LINUX Operating System.

Unit - III

Inter-process Communication : Critical Section, Race Conditions, Mutual Exclusion, Peterson's solution, Hardware Solution, Semaphores, Monitors, Message Passing, Classical IPC Problems: Producer-Consumer Problem, Reader-Writer Problem, Dinning Philosopher Problem etc.Unit IV:

Deadlocks : Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Unit - V

Memory Management : Basic concept, Logical and Physical address mapping, Memory allocation: Contiguous Memory allocation – Fixed and variable partition, Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation, Hardware support for paging, Protection and sharing, Advantages & Disadvantages of paging.

Virtual Memory : Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/ Dirty bit, Demand paging; Page Replacement algorithms: First in First Out (FIFO), Least Recently used (LRU), and Optimal.

Unit - VI

File Management : Concept of File, Access methods, File types, File operations, Directory structure, File System structure, Allocation methods, Free-space management.

Disk Management : Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, LOOK, C- LOOK, Disk reliability, Disk formatting, Boot block, Bad blocks, case study on File Systems in LINUX operating System.

Course Outcomes

On successful completion of the course, students will be able to:

1. Describe and Classify differing structures for operating systems.
2. Understand the role of various components (process, page, file systems etc) of operating system.
3. Analyze and apply resource (CPU, Memory, Disk) management policies.
4. Determine challenges in inter process communication and design solution for it.

Text Books

1. Operating System Concepts, 8th Edition by A. Silberschatz, P.Galvin, G. Gagne, Wiley India Edition.
2. Modern Operating Systems, 2nd Edition by Andrew Tanenbaum, PHI.

Reference Books

1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
2. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP205 **Course : Operating System Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

Using C language in Linux environment

1. To develop ability of students to design and implement concepts of operating systems such as system calls, CPU scheduling, process/thread management.
2. To develop the components and management aspects of concurrency management, memory management, and File management.

Syllabus

Experiments based on CCT205 Syllabus.

Course Outcomes

On completion of the course the student will be able to :

1. Demonstrate LINUX commands and implement system commands.
2. Implement process and process schedulers.
3. Design and implement solution to handle synchronization and deadlock.
4. Implement memory management and File management solutions.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT206 **Course : Design and Analysis of Algorithms**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

1. Students should learn techniques for effective problem solving in computing.
2. Students should analyze different paradigms of problem solving to solve a given problem in efficient way.

Syllabus

UNIT - I

- Mathematical foundations for arithmetic and geometric series, Recurrence relations and their solutions, Principles of designing algorithms and complexity calculation, Asymptotic notations for analysis of algorithms, worst case and average case analysis, amortized analysis and it's applications.

UNIT - II

- Divide and Conquer- basic strategy, Binary Search, Quick sort, Merge sort, Strassen's matrix multiplication, Maximum sub-array problem, Closest pair of points problem, Convex hull problem.

UNIT - III

- Greedy method – basic strategy, fractional knapsack problem, Minimum cost spanning trees, Huffman Coding , activity selection problem ,Find maximum sum possible equal to sum of three stacks, K Centers Problem.

UNIT - IV

- Dynamic Programming -basic strategy, Bellmen ford algorithm, all pairs shortest path, multistage graphs, optimal binary search trees, traveling salesman problem, String Editing, Longest Common Subsequence problem and its variations.

UNIT - V

- Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph coloring, Hamiltonian cycles, sum of subset problem, Introduction to Approximation algorithm.

UNIT - VI

- NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP complete, decision and optimization problems, polynomial reduction, graph based problems on NP Principle , vertex cover problem, clique cover problem

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand mathematical formulation, complexity analysis and methodologies to solve the recurrence relations for algorithms.
2. Design Greedy and Divide and Conquer algorithms and their usage in real life examples.
3. Design Dynamic programming and Backtracking Paradigms to solve the real life problems.
4. Understand NP class problems and formulate solutions using standard approaches.

Text Books

1. Thomas H. Cormen et.al; “Introduction to Algorithms”; 3 Edition; Prentice Hall, 2009.
2. Horowitz, Sahani and Rajasekaram; “Computer Algorithms”, Silicon Press, 2008.
3. Brassard and Bratley; “Fundamentals of Algorithms”, 1 Edition; Prentice Hall, 1995. 4. Richard Johnsonbaugh, “Algorithms”, Pearson Publication, 2003.

Reference Books

1. Parag Himanshu Dave, Balchandra Dave, “Design and Analysis of Algorithms” Pearson Education, O'relly publication
2. Richard Johnsonbaugh, “Algorithms”, Pearson Publication, 2003.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP206 **Course : Design and Analysis of Algorithms Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

1. Analyze the performance of algorithms.
2. Demonstrate a familiarity with major algorithms and data structures.
3. Apply important algorithmic design paradigms and methods of analysis.

Syllabus

Experiment based on syllabus of Design and Analysis Algorithms (CCT206).

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze greedy paradigm and implement greedy algorithms.
2. Analyze divide-and-conquer paradigm and synthesize divide-and-conquer algorithms.
3. Implement algorithms using Dynamic Approach and analyze it to determine its computational complexity.
4. Apply backtracking paradigm to realize real world problems.

Text Books

1. Thomas H. Cormen et.al. "Introduction to Algorithms", Prentice Hall of India.
2. Horowitz, Sahani, Rajsekharam, "Computer Algorithms", Galgotia Publications Pvt. Ltd.

Reference Books

1. Brassard, Bratley, "Fundamentals of Algorithms", Prentice Hall
2. Algorithms – A Creative Approach, 3RD Edition, Udi Manber, Addison-Wesley, Reading, MA.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT207 **Course : Theory of Computation**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

1. To provide students an understanding of basic concepts in the theory of computation.
2. To teach formal languages and various models of computation.
3. To exhibit fundamental concepts related with computability theory.

Syllabus

UNIT - I

Basics of Sets and Relation, Countability and Diagonalisation, Principle of mathematical induction, Pigeon-hole principle. Fundamentals of formal languages and grammars, Chomsky hierarchy of languages.

UNIT - II

Finite automata : Deterministic finite automata (DFA), Nondeterministic finite automata (NFA) and equivalence with DFA, Minimization of finite automata, NFA with Epsilon Transitions, Finite Automata with output.

UNIT - III

Regular expressions and Regular languages, Regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, Context- free grammars (CFG) and language (CFL), parse trees, ambiguity in CFG, Reduction of CFGs, Chomsky and Greibach normal forms.

UNIT - IV

Push Down Automata : Deterministic pushdown automata and Non-Deterministic pushdown automata, Acceptance by two methods: Empty stack and Final State, Equivalence of PDA with CFG, closure properties of CFLs.

UNIT - V

Turing machines : The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages, variants of Turing machines, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT - VI

Undecidability : Church-Turing thesis, Universal Turing machine, Undecidable problems aboutv languages, Recursive Function Theory.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Describe the formal relationships among machines, languages and grammars.
2. Design and Optimize finite automata for given regular language.
3. Design Push Down Automata, Turing Machine for given languages.
4. Demonstrate use of computability, decidability, recursive function theory through problem solving.

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory,Languages, and Computation, Pearson Education Asia.

Reference Books

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCT208 **Course : Cryptography**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 3**

Course Objectives

To understand basics of Cryptography.

To be able to secure a message over insecure channel by various means.

To learn about how to maintain the Confidentiality, Integrity and Availability of data To understand various protocols to protect against the threats in the networks.

Syllabus

UNIT - I

Introduction to Cryptography

Introduction to security attacks - services and mechanism, Mathematics of Cryptography- Integer Arithmetic, Modular Arithmetic, introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography

UNIT - II

Stream & Block Ciphers

Mathematics of Symmetric-key Cryptography- Algebraic Structures- Groups, ring & Finite field, stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard (DES) - strength of DES - block cipher modes of operations - DES – AES.

Unit - III

Confidentiality and Modular Arithmetic

Confidentiality using conventional encryption - traffic confidentiality - key distribution , Mathematics of Asymmetric-key cryptography- random number generation - Introduction to graph, prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - - discrete algorithms.

Unit - IV

Public key cryptography and Authentication requirements

Principles of public key crypto systems - RSA algorithm - security of RSA - key management

– Diffie-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography

– Elgamal encryption – Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit - V

Integrity checks and Authentication algorithms

MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service

Unit - VI

Application Layer Security, IP Security and Key Management

Electronic mail security-pretty good privacy (PGP), S/MIME, IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management.

Course Outcomes

1. Understand various cryptographic Techniques.
2. Apply various public key cryptography techniques.
3. Implement hashing and digital signature techniques.
4. Apply IP security techniques.

Text Books

1. William Stallings, "Cryptography and Network security Principles and Practices", Pearson / PHI, 5th Edition
2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
3. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security" 3rd Edition, McGrawHill.

Reference Books

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CCP208 **Course : Cryptography Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

Using programming languages in Linux environment

1. To develop ability of students to understand and implement concepts of various cryptographic techniques

   To make students aware of various Integrity checks and Authentication algorithms

2. To make students familiar with Application layer security

Syllabus

Experiments based on CCT208 Syllabus.

Course Outcomes

On completion of the course the student will be able to:

1. Understand and implement various public key cryptography techniques
2. Apply various types of integrity checks and authentication mechanisms.
3. Design and Implement Application layer security techniques

Syllabus for Semester IV, BE Computer Science & Engineering (Cyber Security)

Course Code : CHT252 **Course : Environmental Sciences**

L: 2Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 0**

Syllabus

Principle of contaminant behaviour and recent trends in environmental pollution control.

UNIT - I

Air pollution and its control techniques: (4 lectures)

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs). Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

UNIT - II

Noise pollution and its control techniques: (2 lectures)

Introduction to noise pollution and its causes. Noise pollution control: Recent advances in noise pollution control and benefits.

UNIT - III

Soil pollution and its control techniques: (5 lectures)

Soil pollution: Soil around us, Soil water characteristics, soil pollution. Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming, constructed wetlands),and phytoremediation. Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals

UNIT - IV

Water pollution and its control techniques: (8 lectures)

Major sources of water pollution: Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics Techniques to control water pollution: Conventional waste water treatment-types of sewage, ewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal. Case studies: Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

UNIT - V

E-wastes (2 lectures)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

UNIT - VI

Environmental Sustainability: Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification- its importance and implementation VII- Different government initiatives (2 lectures)

National ambient air quality standard 2009, Swacch Bharat Abhiyan, National afforestation program and Act- 2016, National river conservation plan, Formation of National Green Tribunal

Course Outcomes

On successful completion of the course, students

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual's outlook, so as to perceive our Environmental issues correctly, using practical approach based on observations and self-learning.
3. Will become conversant with recent waste management techniques such as E- wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Text Books

1. Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth - Heinemann
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S.Chand & Company Ltd. Sultan Chand & Company
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. P.T. Anastas & J.C. Warner, Green Chemistry: Theory & practice, Oxford University Press

P. Thangavel & Sridevi, Environmental Sustainability: Role of Green technologies, Springer publications.