30.1.4

UNIVERSITY SCHOOL
OF
INFORMATION AND COMMUNICATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME STRUCTURE

B.TECH. COMPUTER SCIENCE AND ENGINEERING

SPECIALIZATION : CYBER SECURITY

2021-2025

30.1.3
08.09.23

GAUTAM BUDDHA UNIVERSITY
GAUTAM BUDH NAGAR, GREATER NOIDA, UP, INDIA

School of ICT
Gautam Buddha University
Greater Noida, (U.P.)

SEMESTER I

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	MA101	Engineering Mathematics-I	3	1	0	4	GE1
2	PH102	Engineering Physics	3	1	0	4	GE2
3	EE102	Basic Electrical Engineering	3	1	0	4	GE3
4	ME101	Engineering Mechanics	3	1	0	4	GE4
5	ES101	Environmental Studies	3	1	0	4	OE1 / AECC
6	PH104	Engineering Physics Lab	0	0	2	1	GE-L1
7	EE104	Basic Electrical Engineering Lab	0	0	2	1	GE-L2
8	EN151	Language Lab	0	0	2	1	OE-L1 / SEC
9	ME102	Workshop Practice	1	0	2	2	GE-L3 / SEC
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**16**	**5**	**8**	**25**	

SEMESTER II

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CS101	Fundamentals of Computer Programming	3	1	0	4	CC1 / FC
2	CCC02	Introduction to Cyber Security	2	0	0	2	CC2 / FC
3	MA102	Engineering Mathematics-II	3	1	0	4	GE5
4	EC101	Basic Electronics Engineering	3	1	0	4	GE6
5	CS102	Computer Organistaion and Architecure	3	1	0	4	CC3
6	EN101	English Proficiency	2	0	0	2	OE2 / AECC
7	CE103	Engineering Graphics Lab	1	0	2	2	GE-L4
8	CS181	Computer Programming Lab	0	0	2	1	CC-L1 / SEC
9	CC182	Cyber Security Lab	0	0	2	1	CC-L2 / SEC
10	EC181	Basic Electronics Engineering Lab	0	0	2	1	GE-L5
11	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**14**	**3**	**8**	**25**	

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SEMESTER III

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC201	Internet Technology	3	0	0	3	CC4 / SEC
2	CC203	Operating Systems	3	0	0	3	CC5
3	CC205	Data Structure & Algorithms	3	0	0	3	CC6 / SEC
4	CC207	Introduction to Python	3	0	0	3	CC7
5	CC209	Information Retrival Systems	3	0	0	3	CC8
6	MA201	Engineering Mathematics-III	3	1	0	4	GE7
7	CC281	Internet Technology Lab	0	0	3	2	CC-L3
8	CC283	Data Structure & Algorithms Lab	0	0	3	2	CC-L4 / SEC
9	CC285	Python Programming Lab	0	0	3	2	CC-L5 / SEC
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**1**	**9**	**25**	

SEMESTER IV

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC202	Software Engineering	3	0	0	3	CC9
2	CC204	Database Management System	3	0	0	3	CC10 / SEC
3	CC206	Java Programming	3	0	0	3	CC11
4	CC208	Artificial Intelligence	3	0	0	3	CC12
5	CC210	Information Theory and Coding	3	0	0	3	CC13
6	CC212	Theory of Automata	3	1	0	4	CC14 / SEC
7	CC282	Database Management System Lab	0	0	3	2	CC-L6 / SEC
8	CC284	Java Programming Lab	0	0	3	2	CC-L7 / SEC
9	CC286	Information Theory and Coding Lab	0	0	3	2	CC-L8 / SEC
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**1**	**9**	**25**	

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SEMESTER V

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC301	Compiler Design	3	0	0	3	CC15 / AECC
2	CC303	Soft Computing Techniques	3	0	0	3	CC16
3	CC305	Analysis and Design of Algorithms	3	0	0	3	CC17 / SEC
4	CC307	Cryptography and Data Privacy	3	0	0	3	CC18
5	CC309	Machine Learning	3	1	0	4	CC19 / SEC
6		Elective 1	3	0	0	3	E1 / DSE
7	CC381	Analysis and Design of Algorithms Lab	0	0	3	2	CC-L9 / SEC
8	CC383	Cryptography and Data Privacy Lab	0	0	3	2	CC-L10 / SEC
9	CC385	Machine Learning using Python Lab	0	0	3	2	CC-L11 / SEC
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**1**	**9**	**25**	

SEMESTER VI

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC302	Web Development using PHP	3	0	0	3	CC20
2	CC304	Network Defense for Cyber Security - Risk Management and Audit	3	0	0	3	CC21
3	CC306	Cloud Computing	3	1	0	4	CC22
4	CC308	Digital Forensic, Audit and Investigations	3	0	0	3	CC23
5	CC310	Data Privacy and Database Security	3	0	0	3	CC24 / SEC
6		Elective 2	3	0	0	3	E2 / DSE
7	CC382	Web Development using PHP Lab	0	0	3	2	CC-L12 / SEC
8	CC384	Network Defense for Cyber Security Lab	0	0	3	2	CC-L13
9	CC386	Data Privacy and Database Security Lab	0	0	3	2	CC-L14
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**1**	**9**	**25**	

Industrial Training will be done by candidate individually after third year during the summer break and it will be of minimum 4 weeks. It will be evaluated as per University Examination in VII semester.

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SEMESTER VII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC401	Parallel Processing and CUDA Programming	3	1	0	4	CC25
2	CC403	Blockchain Technology	3	0	0	3	CC26
3	CC405	AI Enabled Cyber Security	2	0	0	2	CC27 / SEC
4		Elective 3	3	0	0	3	E3 / DSE
5		Elective 4	3	0	0	3	E4 / DSE
6	CC481	AI Enabled Cyber Security Lab	0	0	3	2	CC-L15
7	CC491	Minor Project	0	0	10	5	MP1 / E
8	CC493	Industrial Traning	0	0	6	3	IT1 / E
9	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**14**	**1**	**19**	**25**	

SEMESTER VIII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC490	Seminar	0	0	3	2	S / E
2	CC492	Major Project	0	0	16	8	MP2 / E
3	CC494	Intenship	0	0	30	15	I / E
4	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**0**	**0**	**49**	**25**	

GRAND TOTAL OF CREDITS = 200

In the **Seminar**, student need to study and present individually, on latest research paper of their specialized area and It will be evaluated as per University Examination Rules.

The **Internship** in Industry will be done by candidate individually during the 8th semester and it will be for a minimum of 4 (-6) months. It will be evaluated as per University Examination Rules.

Minor and Major Project will be in a group and It will be evaluated as per University Examination Rules.

USICT will provide a mentor/supervisor for industrial training, seminar, internship, minor and major projects.

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ELECTIVES FROM DCSE

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CC311	Security Information & Event Management	3	0	0	3	E1
2	CC313	Intrusion Detection and Prevention System	3	0	0	3	E1
3	CC315	Cryptography	3	0	0	3	E1
4	CC317	Biometric System and Security	3	0	0	3	E1
5	CC319	Data Mining	3	0	0	3	E1
5	CC312	Mobile Security	3	0	0	3	E2
6	CC314	Cloud Architecture and Security	3	0	0	3	E2
7	CC316	Principle of Secure Coding	3	0	0	3	E2
8	CC318	Information Warfare	3	0	0	3	E2
9	CC320	Ethical Hacking	3	0	0	3	E2
10	CC407	Social Network Security	3	0	0	3	E3
11	CC409	Physical Security of IT Infrastructure	3	0	0	3	E3
12	CC411	NISTA 800-53 (Security Control)	3	0	0	3	E3
13	CC413	Operating Systems Security	3	0	0	3	E3
14	CC415	Mobile and Wireless Network Security	3	0	0	3	E3
15	CC417	Enterprise Security and Management	3	0	0	3	E3
16	CC419	Malware Analysis	3	0	0	3	E4
17	CC421	Android Security Design and Internals	3	0	0	3	E4
18	CC423	Data and Database Management Security	3	0	0	3	E4
19	CC425	Web Application and Penetration Testing	3	0	0	3	E4
20	CC427	Access Control and Identity Management Systems	3	0	0	3	E4

CC Computer Science & Engineering / Cyber Security for Course Code

Core Course from USICT for Type of Course

GE General Elective from related discipline of other Deptt./School

GE L General Elective Lab from related discipline of other Deptt./School

OE Open Elective from other discipline of other Deptt./School

AECC Ability Enhancement Compulsary Course

DSE Discipline Specific Course

SEC Skill Enhancement Course

E Elective from USICT

CC-L Core Course Lab from USICT

IT1 Industrial Training

MP Minor / Major Project

S Seminar

I Internship

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THEORY OF AUTOMATA			
Course Code:	**CC212**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
1. Define various categories of automata (deterministic and nondeterministic finite state automata, and variants of Turing machines)
2. Define the various categories of languages and grammars in the Chomsky hierarchy
3. Define the notions of computability and decidability
4. Recognize to which class in the Chomsky hierarchy the language described (by a grammar or machine)
5. Recognize problems reducible to/from well-known decidable/undecidable problems

COURSE OUTCOMES
At the end of the course the students should be able to:
1. Model, compare and analyse different computational models using combinatorial methods.
2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
3. Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
4. Identify limitations of some computational models and possible methods of proving them.
5. Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.

UNIT I INTRODUCTION

Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

UNIT II REGULAR EXPRESSION (RE)

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

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UNIT III CONTEXT FREE GRAMMAR (CFG) AND CONTEXT FREE LANGUAGES (CFL)

Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

UNIT IV PUSH DOWN AUTOMATA (PDA)

Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.

UNIT V TURING MACHINES (TM)

Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Text Books:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
2. KLP Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.
3. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
4. YN Singh "Mathematical Foundation of Computer Science", New Age International.
5. Malviya, AK "Theory of Computation and Application", BPaperback Publications
6. Papadimitrou, C. and Lewis, CL, "Elements of the Theory of Computation", Pearson Publication.
7 K. Krithivasan and R. Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.

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INFORMATION THEORY & CODING LAB			
Course Code:	**CC286**	**Course Credits:**	**2**
Course Category:	**CC-L8/SEC**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Labs (Hrs/Week):	**3 hrs**	**Mid Sem. Exam Hours:**	
Total No. of Labs:	**10**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
1.To study Fourier perspective; and extensions to wavelets,complexity, compression, and efficient coding of audio-visual information
2. To study Fourier perspective; and extensions to wavelets,complexity, compression, and efficient coding of audio-visual information
3. To implement to calculate the capacity of a communication channel, with and without noise; coding schemes, including error correcting and codes
4. To understand how discrete channels and measures of information generalise to their continuous forms
5. To study Fourier perspective; and extensions to wavelets,complexity, compression, and efficient coding of audio-visual information
COURSE OUTCOMES
At the end of the course the students should be able to:
1.Understands the fundamentals of coding theory
2.Understands concept of source coding
3. Understands channel coding theorem.
4. Students will demonstrate the error control coding
5. Students will demonstrate various codes

List of Experiments:

1. To revise and write programs for understanding variable scope, swapping integers byreference and checking the number even or odd using ternary operators in C/C++.
2. To revise and write a program for sorting integers numbers, and factorial using recursion,function overloading and inline function.
3. Develop a program to implement the algorithm of Encoding of messages.
4. Develop a program to Compute the Entropy in case of Discrete Algorithm.
5. Develop a program to Compute Entropy of 4 Parts of Message
6. To write a program to Find the Entropy of certain message.in C++
7. Develop and Implement Program to Compute the Capacity of Noiseless Binary Channel.
8. Can computing Binary Entropy Function (Channel Capacity) as follow:

   $$C = 1 - H(p)$$

   Write Program for BSC when px=0.1 find the Hp= 0.468 ~ 0.47

   and Capacity=0.53~0.531.
9. Can Computing BSC (Channel Capacity) in Private Case Study As Follow:

   $$I(X;Y) = H(Y) - H(Y|X)$$

   Write Program For BSC of Private Case Study To Compute Capacity.

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Use an example to illustrate Shannon Fano algorithm.