JK LAKSHMIPAT UNIVERSITY

ज्ञानम् अमृतम्

JKLU

HAND BOOK

of

CURRICULUM STRUCTURE AND SYLLABUS

Bachelor of Computer Applications
(Programme Code: 3108)

Batch: 2021-24

Institute of Engineering and Technology

Vision

To be one of India's most innovative higher education institutions.

Mission

To realise its vision, the University will:

Practice teaching that inculcates critical thinking and problem solving,

Pursue research that leads to innovation and enhancement of real-life applications,

Offer experience that leads to all round development, and

Develop a culture that is strongly rooted in interdisciplinarity and learning by building, not just doing.

Values

Caring for people.

Integrity including intellectual honesty, openness, fairness, and trust.

Commitment to excellence.

IQAC Documentation

Document Name: Curriculum Structure and Syllabus Handbook, Bachelor of Computer Applications (Programme Code: 3108) - Batch 2021-2024

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Document Description: This document supplements the document titled Curriculum Structure: BTech, MTech and BCA Programs and is prepared by the Institute of Engineering and Technology (IET), JKLU to serve as an information baseline for further planning and delivery of courses w.r.t Bachelor of Computer Applications (Programme Code: 3108) - Batch 2021-2024.

It includes Program Education Objectives, Programme Outcomes, Programme Specific Outcomes, Curriculum Structure, collation of Semester wise Course Description, and Course Articulation Matrix (CAM) of each course (including electives and additional courses, if any, opted by students) prepared by respective faculty members. The document also includes Programme Articulation Matrix (PAM).

This document is in compliance with BoS (upto 13th meeting) and approvals of the Academic Council (upto 20th meeting).

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Program Education Objectives

The BCA Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEOCA1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEOCA2: Continue their intellectual development through critical thinking, self- study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEOCA3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEOCA4: Effectively communicate about technical and related issues.

PEOCA5: Embrace the roles of team members and leaders in their careers.

Program Outcomes

The graduates of BCA Programs at IET, JKLU will have following competencies:

POCA1: Life-long learning: Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

POCA2: Citizenship, Sustainability, and Professional ethics

POCA2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the computing solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

POCA2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues, and the consequent responsibilities relevant to the professional IT practice.

POCA2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the IT practice.

POCA3: Computing knowledge and Modern IT tool usage

POCA3a: Demonstrate clear conceptual understanding of fundamentals of computing and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

POCA3b: Apply computational thinking, and the knowledge of, computing fundamentals, information technology, and management to the solution of complex computing problems.

POCA3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern IT tools with an understanding of the limitations.

POCA4: Complex problem solving and Design

POCA4a: Identify, formulate, and analyze complex computing problems to arrive at substantiated conclusions using critical thinking along with principles of computing.

POCA4b: Design and develop information technology solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

POCA4c: Collect, analyse and interpret data to evaluate and improve the information technology solutions and practice.

POCA5: Individual & teamwork and IT management.

POCA5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.

POCA5b: Ability to apply IT management principles to one's own and team's work to manage information technology-based projects and operations and in multidisciplinary environment.

POCA6: Communication: Ability to communicate effectively on information technology related activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, computing community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.

POCA7: Innovation and entrepreneurship:

POCA7a: Demonstrate enthusiasm and understanding to identify opportunities and translate new developments in information technology and other disciplines to conceive and design innovative IT solutions for business, industry, and societal problems.

POCA7b: Demonstrate enthusiasm and understanding to conceive and plan IT based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcomes

The BCA graduates of JKLU will be able to:

BCAPSO1: Conceive, design, implement, and manage data management and information processing systems, services and processes by using principles, techniques and practices of computer programming, data management, application development, data analytics, system administration, sustainability and state of the art platforms, components and tools.

BCAPSO2: Serve in ICT areas such as application development, data administration, system administration, data analytics, cyber security, digital media in business, consultancy, industry, government, healthcare, schools, etc., or computer teaching in schools.

Program specific desired minimum level of competence for POs and PSOs

PO/PSO	Competence Level
POCA 1	Advanced Beginner
POCA 2a	Novice
POCA 2b	Novice/Advanced Beginner
POCA 2c	Novice
POCA 3a	Advanced Beginner
POCA 3b	Advanced Beginner
POCA 3c	Advanced Beginner
POCA 4a	Advanced Beginner
POCA 4b	Novice
POCA 4c	Novice
POCA 5a	Advanced Beginner
POCA 5b	Novice
POCA 6	Advanced Beginner
POCA 7a	Novice
POCA 7b	Novice
BCAPSO 1	Advanced Beginner
BCAPSO 2	Advanced Beginner

Following process has been adopted to create Course Articulation Matrix (CAM) and Program Articulation Matrix (PAM).

- Course Outcome of each Course is mapped to Program Outcome (PO) / Program Specific Outcome (PSO) using three Levels viz., Low Correlation (1), Moderate Correlation (2) and Substantial Correlation (3).
- Average of these Levels of each Course Outcome w.r.t each specific PO/PSO is calculated, and it indicates expectations laid in a course to attain different PO/PSO. In order to avoid over commitment of a course w.r.t its contribution to POs/PSOs, the following validation check is applied on the sum of PO/PSO wise averages in each course.

$\sum$ (Average) <= Min (Credits * Year, 15)

In above equation, Credits are the credits assigned to the course, Year indicates the level of the students from 1st to 3rd year. In case this sum exceeds the upper limit, CO-PO mappings are revised. This check ensures that early or low credit courses are not over burdened with very high expectations.

- For creation of Program Articulation Matrix, sum of these averages of different courses w.r.t each PO/PSO is calculated and interpreted as per following Table.

Competence Level *	BCA
Novice	<8
Advanced Beginner	8 - 16
Competent	>=16

Novice* (N): Knows objective facts, features, and rules for determining actions w.r.t this PO/PSO without being context-sensitive. The student has studied the basic concepts.

Advanced beginner* (AB): Recognizes common situations w.r.t this PO/PSO that help in recalling which rules should be exercised, starts to recognize and handle situations not covered by given facts, features and rules. The student has problem-solving and repeated practice experience for common situations w.r.t this PO/PSO.

Competent* (C): Performs most standard actions w.r.t PO/PSO without conscious application of rules after considering the whole situation. Handles new situations through the appropriate application of rules, can design systems, and may lead. Has demonstrated this PO/PSO through repeated engagements in advanced problem-solving, projects, extensive practice in common and exception situations, and participated in professional networks.

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Curriculum Structure
Bachelor of Computer Applications (Batch 2021-2024)

Sem	Courses						Credits
I	Problem Solving with Python CS1115 (3 0 4) 5	Database Management and Applications CS1116 (3 0 4) 5	Computer Organisation and Systems CS1117 (3 0 2) 4	Mathematics AS1104 (3 1 0) 4	Fundamentals of Communication CC1101 (2 0 1) 2		**20**
II	Java Programming CS1118 (3 0 4) 5	Web Application Development CS1119 (3 0 2) 4	Operating Systems and Linux Administration CS1120 (2 0 4) 4	Computational Mathematics AS1105 (3 0 2) 4	Principles of Management IL1103 (3 0 0) 3	Critical Thinking and Storytelling CC1102 (2 0 1) 2	**22**
III	C++ Programming and Data Structures CS1122 (3 0 4) 5	Android Application Development CS1123 (3 0 2) 4	Computer Networks and Network Administration CS1124 (2 0 4) 4	Statistical Computing AS1106 (3 0 2) 4	Economics and Accounting IL1104 (3 0 0) 3	Perspectives on Contemporary Issues CC1103 (2 0 1) 2	**22**
IV	Algorithm Design and Analysis CS1126 (3 0 2) 4	Robotic Process Automation Lab CS1125 (0 0 4) 2	Applied IoT EE1117/ Multimedia Lab (0 0 4) 2	Virtualisation and Cloud computing CS1127 (2 0 4) 4	Communication and Identity CC1104 2	Elective I 4	**18**
V	BCA Practice School-I (6-8 Weeks Duration) - 4 Credits						**19**
	Applied Artificial Intelligence and Machine Learning (3 0 2) 4	Software Quality and Testing/ Information Security (2 0 2) 3	Open-Source Software Deployment/ 3D Design and Animation Lab (0 0 4) 2	Understanding and Managing Conflicts CC1105 2	Elective II 4	Open Elective (3 0 2) 4	
VI	BCA Practice School-II OR						**16**
	Semester at a partner University abroad or in India OR						
	Project 6	Critical Thinking for Decisions at Workplace CC1106 2	Elective III 4	Elective IV 4			
	Total Credits						**121**

- For every credit, in each course, every student is expected to put in a total work of 35-36 hours including the class time. The specified teaching scheme is applicable if the course is taught as full semester course. However, sometimes, a few courses may actually be completed in a shorter duration by increasing the weekly contact hours.
- Upto 6 courses can be replaced by appropriate Curated MOOCs with prior permission. For example, students with very strong mathematics background in 12th class can replace the Ist semester mathematics course by an appropriate advanced mathematics MOOC.
- Optional Concentrations: (1) Data Analytics, (2) Cloud Computing and Cyber Security, (3) Robotic Process Automation. Students will have to complete 2 electives and project/PS-II (total 14+ credits) in the chosen field.

List of Electives	
Sem IV	
Elective I	
Functional Electronics	
Cybersecurity	

Index of Course Descriptions

Course Title and Code: CS1115–Problem Solving with Python	
Hours per Week	**L-T-P: 3-0-4**
Credits	**5**
Students who can take	BCA Sem I (2021-2024)

Course Objective- The aim of the course is to build up a clear understanding of the fundamentals of computer programming. The course is taught using Python programming language. We will discuss the topics necessary for the students to understand and write computer programs on their own.

Course Outcomes:

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

CS1115.1. Design structure and components of a Python program.

CS1115.2. Use Python Control and Decision-making Structures for writing programs

CS1115.3. Use lists, tuples, and dictionaries in Python programs.

CS1115.4. Read and write files in Python.

CS1115.5. Use exception handling in Python applications for error handling.

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	20
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	20
14	Lab Evaluation I (Continuous)	10
15	Lab Evaluation II (Test)	10
16	Course Portfolio	Nil
	Total (100)	**100**
Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	10
	Total	**30**

Syllabus (Theory)

Fundamentals of Python: Beginnings with Python, Parts of a Program: Modules, Statements and Expressions, Whitespace, Comments, Special Python Elements: Tokens, Naming Objects, Variables, Objects and Types, Operators;
Control: The Selection Statement for Decisions: if, if-else, nested if.

Repetition: for Statement, In-Depth Control: Boolean Variables, Relational Operators, Boolean Operators, Precedence, while Statement, Nesting.

Functions: What Is a Function? Python Functions, Flow of Control with Functions, Scope, Arguments, Parameters, Default Values and Parameters, Functions as Objects;

Strings: The String Type, String Operations, Formatted Output for Strings;

Lists and Tuples: What Is a List? Iteration, Indexing and Slicing, Operators, Lists vs Strings, Split and Other Functions and Methods, Anagrams, Tuples from Lists.

Dictionaries and Sets: Dictionaries, Python Dictionaries, Dictionary Indexing and Assignment, Sets, Python Sets, Methods, Operators, and Functions for Python Sets, Set Methods;

Files and Exceptions: What Is a File? Accessing Files: Reading Text Files, Accessing Files: Writing Text Files, Reading and Writing Text Files in a Program, File Creation and Overwriting, Handling Errors: Error Names, the try-except Construct, try-except Flow of Control, Exception;

Reference Books:

1. William Punch, Richard Enbody, 'The Practice of Computing Using Python'. Pearson, 2016
2. Allen B. Downey. Think Python. Green Tea Press, Massachusetts, USA.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES													CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1115.1								1	1	1						2	
CS1115.2					1	1	1	1	2	1						1	
CS1115.3					1	1	1	1	2	1						1	
CS1115.4					1	1	1	1	2	1						1	
CS1115.5					1	1	1	1	2	1						1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

CS1116: Database Management and Applications

Course Title and Code: Database Management and Applications (CS1116)	
Hours per Week	**(3 0 4)**
Credits	**5**
Students who can take	**Bachelors in computer application (BCA)**

Course Objectives: This course introduces an understanding of the fundamental concepts of database systems and modelling of real-world problems using ER-model /UML and to convert ER model into relational model. This course helps students to implement SQL and to normalize a given database. It also includes usage of Excel to analyze database system.

Learning Outcome:
On successful completion of this course, the students should be able to:

CS1116.1. Outline database system components and their functions
CS1116.2. Model the real-world systems from the given requirements specification using Entity Relationship Diagrams/Unified Modelling Language
CS1116.3. Apply SQL commands to define, query and manipulate a relational database
CS1116.4. For a given query, write relational algebra expressions and optimize the same.
CS1116.5. Normalize a given database up to Boyce Codd Normal Form (BCNF) based on identified keys and functional dependencies
CS1116.6. Use Excel to import data from Database and analyze it for decision making.

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam -II	Nil
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project -I	20
12	Project -II	Nil
13	Project -III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	Nil

16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30
2	Lab Evaluation	Nil

Course Contents:

UNIT I: Basic Concepts: data, database, database systems, database management systems, instance, schema, Database Applications, Purpose and Advantages of Database Management System (over file systems); Dynamic web applications, Database design standards, Web design standards; View of Data (Data Abstraction, Data Models), Database Languages (DML, DDL), Relational
Databases (Tables, DML, DDL), Data Storage and Querying (Components,

Storage Manager, Query Processor), Database Architecture, Database

User and Administrators

UNIT II: Design Phases, Design Alternatives (Major Pitfalls), Entity Relational Model (Entity Sets, Relationship Sets, Attributes), Constraints (Mapping Cardinalities, Keys, Participation Constraints), Entity Relationship Diagram,

Weak Entity Set, Extended E-R features (Generalization, Specialization and Aggregation), E-R Notations, Examples of ERD

UNIT III: Features of Good Relational Design, Atomic Domain and First Normal Form, Decomposition Using Functional Dependency (Key and Functional Dependency, BCNF, 2NF, 3NF), Functional Decomposition Theory (Closure Set of Functional Dependency with Armstrong Rules, Canonical Cover and Lossless Decomposition), Dependency Preservation, Comparison of 3NF and BCNF,

UNIT IV: Structure of Relational Databases (Basic Structure, Database Schema, Types of Keys), Fundamental Relational Algebra Operations (Select, Project, Union, Set Difference, Cartesian Product and Rename Operator), Additional Relational Algebra Operators (Set Intersection, Natural Join, Division Operator, Assignment Operator), Examples

UNIT V: Hands on Excel, Importing Database in Excel, applying database functions in Excel, analyzing database using Excel.

Reference Books:

1. Silberschatz, Abraham, Henry F. Korth, and Shashank Sudarshan. *Database system concepts*. Vol. 4. New York: McGraw-Hill, 1997.
2. Date, Christopher John. *An introduction to database systems*. Pearson Education India, 2006.
3. Singh, Shio Kumar. *Database systems: Concepts, design and applications*. Pearson Education India, 2011.
4. Elmasri, Ramez, and Shamkant Navathe. *Fundamentals of database systems*. Addison-Wesley Publishing Company, 2010.
5. Coronel, Carlos, and Steven Morris. *Database systems: design, implementation, & management*. Cengage Learning, 2016.

Course Articulation Matrix: (Mapping of COs with POs)

CO	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO 1	PSO 2
CS1116.1	1																
CS1116.2	1		1			1		1			1		1			1	1
CS1116.3	1				1	1	1		1	1		1	1	1		1	1
CS1116.4	1			1	1		1			1							
CS1116.5	1	1		1	1		1					1		1		1	1
CS1116.6	1					1				1	1	1		1		1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Computer Organisation and Systems (CS1117)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	BCA SEM-I

Course Objectives: To study the basic organization and architecture of digital computers (CPU, memory, I/O, software). Discussions will include digital logic and microprogramming. Learners would be able to program to optimize cache hit and estimate cost of different hardware for the number systems. Such knowledge leads to better understanding and utilization of digital computers and can be used in the design and application of computer systems or as foundation for more advanced computer-related studies.

Course Outcome:

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

CS1117.1. Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

CS1117.2. Summarize and compare different computer systems.

CS1117.3. Categorize different types of computers based on Instruction set Architecture.

CS1117.4. Develop assembly language programs for multiplication, division, and I/O interface using 8086.

CS1117.5. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.

CS1117.6. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

CS1117.7. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

CS1117.8. Analyze the performance of pipeline and cache-based systems.

CS1117.9. Design algorithms to optimize hit-rate in cache memory.

CS1117.10. Program and estimate the execution time of arithmetic functions using different number systems.

Prerequisites		
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	20
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
	Total (100)	100

	Re-Test Evaluation	
	Theory Exam-III	30
	Total:	30

Course Syllabi (Theory):

Unit I: DIGITAL FUNDAMENTALS: Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Combinational and Sequential circuits.
Unit II: BASIC STRUCTURE OF COMPUTERS: Functional units, Basic operational concepts, Bus structures, Number, Instructions and instruction sequencing, Instruction set architecture, Addressing modes, RISC, CISC. ALU design, Fixed point and floating-point operations.
Unit III: BASIC PROCESSING UNIT: Fundamental concepts, Execution of a complete instruction, Multiple bus organization, Hardwired control, Micro programmed control, Pipelining.
Unit IV: MEMORY SYSTEM: Basic concepts, Memory Hierarchy, Semiconductor RAM, ROM, Speed, Size and cost, Cache memories, Virtual memory, Memory management, Associative memories, Secondary storage devices.
Unit V: I/O ORGANIZATION: Accessing I/O devices, Programmed Input/Output, Interrupts, Direct Memory Access, Buses, Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.

Text Books:

1. Mano, M. Morris. "Computer system architecture, 1993." Prentice Hall 3: 299.

2. Stallings, William. Computer organization and architecture: designing for performance. Pearson Education India, 2003.

Reference Books:

1. Patterson, David A., and John L. Hennessy. Computer Organization and Design MIPS Edition: The Hardware/Software Interface. Newnes, 2013.

2. Hayes, John P. Computer architecture and organization. McGraw-Hill, Inc., 2002.

3. Heuring, Vincent P., Harry Frederick Jordan, and Miles Murdocca. Computer systems design and architecture. Addison-Wesley, 1997

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1117.1	1																
CS1117.2		1		1											1		
CS1117.3						1		2		1	1			1			1
CS1117.4			1												1	1	1
CS1117.5												1					
CS1117.6					1		1	1			1			1			1
CS1117.7	1	1															
CS1117.8					1							1		1		1	
CS1117.9	1						1		1						1		2
CS1117.10					1						1	1		1	1	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Mathematics (AS1104)	
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	BCA Semester I (**Core**)

Course Objective: This course introduces the fundamental concepts of Higher Algebra and Calculus. The course will cover the mathematical tools that can be used in the areas of computer application.

Course Outcomes:

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

AS1104.1: apply the principles of counting in the areas of their interest.

AS1104.2: use Set theoretic approach as a tool especially in the areas of computer applications.

AS1104.3: compute derivatives of elementary functions

AS1104.4: compute definite and indefinite integrals of elementary functions.

AS1104.5: apply the concept of calculus in solving problems related to the rate of change, approximation, extremum problems, finding averages and area.

Prerequisites	High School Algebra and Trigonometry

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	10
4	Quiz	20
5	Theory Exam I	15
6	Theory Exam II	15
7	Theory Exam III	30
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Retest Evaluation Scheme		
1	Theory Exam (End Term)	30
	Total (30)	**30**

Syllabus

Unit 1: Combinatorics
Introduction to infinite series and binomial expansion, Principles of counting
Unit 2: Sets
Definition and types of sets, Set operations, Venn Diagram, Partition of set, Cardinality of a set, Inclusion- Exclusion Principle.
Unit 3: Relations and Functions
Definition and types of functions; Domain, Range and graphs of commonly used functions: logarithmic, exponential, trigonometric, inverse trigonometric; Composition of functions, Inverse of a function.
Cartesian product of sets, Binary relations, Operations on relations, Equivalence relations and Equivalence classes.
Unit 4: Differential Calculus
Concept of limits, Continuity and differentiability; Differentiation; Related rates; Maxima and minima of functions of one variable.
Unit 5: Integral Calculus:
Integration as an inverse process of differentiation, Introduction to the methods of indefinite integration, Definite integrals and its properties, Concept of area of region bounded by simple curves.

Text Books

1. James Stewart, "**Calculus** ", 7th Ed., Brooks/Cole Cengage Learning, 2015.
2. Kenneth Rosen, "**Discrete Mathematics and its applications**", 5th Ed., Tata-McGraw Hill, 2002.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
AS1104.1						1											
AS1104.2	1						1										
AS1104.3						1											
AS1104.4						1											
AS1104.5	1						1										

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	Fundamentals of Communication (CC1101)
Hours per Week	**L-T-P: 2-0-1**
Credits	**2**
Students who can take	B.Tech/BCA Sem I

Course Objective- This course provides an introduction to the importance of effective communication, the consequences of poor communication, and the different elements of verbal and non-verbal communication. Students learn about, and enhance, the components of communication: kinesics, paralanguage (voice) and language.

Course Outcome:

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

CC1101.1 Identify different cultural differences and their impact on communication.

CC1101.2 Compose grammatically correct sentences and paragraphs.

CC1101.3 Deliver effective oral presentations following appropriate kinesics and paralinguistic features.

CC1101.4 Identify impact of cultural differences on communication.

CC1101.5 Apply appropriate communication skills across settings, purposes, and audiences.

Prerequisites		
Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	10
04	Presentation	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Viva	20
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus:
1. Nature and importance of communication
2. Mehrabian's Communication Theory
3. Ethos, Pathos, Logos: The three pillars of persuasive communication
4. English as a Foreign Language
5. Consequences of poor communication
6. Writing Strategy
7. Basic of Effective Presentation
8. Influence of culture on communication
9. Formats of Public speaking (oral narration, conversational skills)
10. Common Errors in English

Reference Books:
- Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principles and Practice. Second Edition. New Delhi: Oxford University Press.
- Mohan, Krishna and Meenakshi Raman. 2010. Advanced Communicative English. New Delhi: Tata McGraw Hill.

Recommended MooCs :
1. Englsih for the Workplace (Offered By British Council)
   https://www.futurelearn.com/courses/workplace-english

2. Rhetoric: Art of Persuasive Writing and Public Speaking (Offered by Harvard University)

   https://online-learning.harvard.edu/course/rhetoric-art-persuasive-writing-   and-public-speaking?delta=2

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1101.1									1		1		1				
CC1101.2																	
CC1101.3	1										1						
CC1101.4																	
CC1101.5	1										1		1				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Name: JAVA Programming
Course Code: CS1118   **L-T-P: 3-0-4. Credits: 5**

Course Objective: This course teaches object-oriented programming to those who have learned basic programming concepts and are ready to learn in-depth programming. It focuses on object-oriented programming using JAVA. The main concepts are Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, Interfaces and Exception Handling.

Course Outcomes:
On successful completion of this course, the students should be able to:
CS1118.1. Develop Java Programs with the concepts of primitive data types, strings, and arrays.
CS1118.2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding.
CS1118.3. Design, develop and debug programs in Core Java using coding and documentation standards.
CS1118.4. Incorporate exception handling in Java Programs.
CS1118.5. Apply Polymorphism, Inheritance, and Interfaces in writing software.

Prerequisites		Programming
Teaching Scheme (Hours per Week)		**3-0-4**
Credits		5
Sr. No.	Evaluation Component	
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	NIL
6	Theory Exam-II	NIL
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	10
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	10
17	Presentation	10
18	Viva	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	10
	Total	30

Basics of Java: Introduction to Java: Features of Java, Byte Code and JVM, JDK, JRE; Data types and Operators: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, ADT, Operator types and precedence.

Decision & Flow Control Statements - Statements and Flow Control: Conditional statements, looping, return, etc.

Array & String - Defining an Array, Initializing & Accessing Array, Multi-Dimensional Array, Operations on String.

OOP's Concept I - Class Fundamentals, Object & Object reference, Access Control, Modifiers, Methods in Java: Method Declarations, Method Signatures, Invoking Methods, Constructors - Constructor & initialization code block, Parameterized Constructor.

OOP's Concept II - Method Overloading, Encapsulation and Abstraction. Inheritance, Overriding vs. Overloading, Polymorphism.

Interfaces - Inner Class & Anonymous Classes, Abstract Class and final class, interfaces**.**

Exception Handling - Introduction to Exception handling.

References

1. Liang, Y. Daniel. Introduction to Java programming: comprehensive version. Pearson Education, 2018.
2. Horstmann, Cay S., and Gary Cornell. Core Java 2: Volume I, Fundamentals. Pearson Education, 2016.
3. Schildt Herbert. The Complete Reference, Java 2, Fourth Edition. TMH, 2017.

MOOC : **https://www.coursera.org/learn/java-object-oriented-programming** **through Coursera**. Student may refer course notes, videos & ppts.

Course Articulation Matrix: (Mapping of COs with POs)

CO	CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM-SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1118.1				1	1		1										
CS1118.2						1	1	1	1								
CS1118.3	1			1	1	1	1	1			1	1				1	
CS1118.4					1	1	1	1									
CS1118.5					1	1	1	1						1			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Web Application Development (CS1119)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.C.A. II Sem

Course Objective: This course will cover all the basics of HTML including the latest in CSS styling. The course focuses on using HTML5/CSS3/JavaScript to implement programming logic, define and use variables, perform looping and branching, develop user interfaces, capture, and validate user input, store data, and create well-structured application.

Learning Outcome:
On successful completion of this course, the students should be able to:
CS1119.1. Lay out HTML elements using CSS margin and padding.
CS1119.2. Implement front end web design in HTML and CSS.
CS1119.3. Design scripts to meet given interface and media control requirements.
CS1119.4. Analyze a visual communication problem, develop a concept, and successfully design and produce a functional website project using web design software - specifically WordPress.
CS1119.5. Build basic security mechanisms for protection of dynamic websites.
CS1119.6. Implement and evaluate pattern matching with regular expressions.
CS1119.7. Implement HTML5 APIs using JavaScript.

Prerequisites: Basic Programming Skills and Database
Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	15
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	20
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
17	Presentation	05
18	Viva	Nil
	Total (100)	100

Retest

1	Theory Exam III	20
	Lab Evaluation-II	10
	Total	30

Course Contents:

Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Home Page Layout, Design Concept.

Basics in Web Design: Brief History of Internet, World Wide Web, utility of web site, Web Standards, Audience requirement. Introduction to WEB, Basics of WWW, HTTP protocol, Client Server architecture, Introduction to web server installation and configuration, Understanding SEO

Introduction to HTML: HTML Documents, Basic structure of an HTML document, creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.

Elements of HTML: Working with Text, working with Lists, Tables and Frames, working with Hyperlinks, Images and Multimedia, working with Forms and controls.

Cascading Style Sheets: Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs.

JavaScript: JavaScript Programming, Writing Functions, Dynamic Web Page Creation, Built in Functions & Methods, Pattern Matching, Events.

WordPress Basics:
Introduction to content management systems based on PHP, Introduction to WordPress, How WordPress Works, Installation of WordPress.

Posts & Pages:
Introduction to Blogging, Creating Blogs, Using Images, Wrapping Text Around Images, Comments, Post Formats, Linking to Posts, Pages, and Categories, Using Similes, Links Manager, WordPress Feeds, Using Password Protection,

Customizing Site Appearance and Themes:
Developing a Color Scheme, Designing Headers, CSS Horizontal Menus, Dynamic Menu Highlighting, Navigation Links, Next and Previous Links, Styling for Print, Designing Your Post, Meta Data Section, Separating Categories in your Post Meta Data Section, Customizing the Read More, Formatting Date and Time, Finding CSS Styles, Creating Individual Pages, Uploading Files, using WordPress Themes, Templates, Template Tags, Template Hierarchy, Validating a Website, Know Your Sources, WordPress Site Maintenance

Text Books:

1. A Thomas, Powell. "HTML & CSS: The Complete Reference Fifth Edition." (2010).

2. Niederst Robbins, J. (2012). Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. Germany: O'Reilly Media, Incorporated.

3. Freeman, Eric, and Elisabeth Robson. Head First JavaScript Programming: A Brain-Friendly Guide. " O'Reilly Media, Inc.", 2014.

Reference Online Course:

https://www.coursera.org/learn/html-css-javascript-for-web-developers

https://www.w3schools.com/html/default.asp

https://www.coursera.org/projects/build-a-full-website-using-wordpress

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CS1119.1	1	1			1		1					1					
CS1119.2					1		1			1						1	
CS1119.3	1			1	1	1	1										
CS1119.4		1				1					1		1			1	
CS1119.5		1		1	1			1	1	1					1		
CS1119.6		1			1		1			1		1					1
CS1119.7					1		1										

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

16

Course Title and Code: Operating Systems and Linux Administration CS1120	
Hours per Week	**L-T-P: 2-0-4**
Credits	**4**
Students who can take	BCA Semester II

Course Objectives:

The main aim of this course is to develop an understanding of the fundamental concepts and techniques of operating systems. The course aims to explain the importance of the operating system, its function and different techniques to achieve its goals as resource manager. The course also elaborates how applications interact with the operating system and how the operating systems interact with the machine. This course builds upon the first Semester course on Computer Architecture & Organisation and lays the foundation for the course on Computer Network and Network Administration.

Course Outcome:

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

CS1120.1. Use basic LINUX commands: file/directory handling, standard I/O, redirection, pipes, and filters.

CS1120.2. Analyze the structure of OS and its interface with hardware.

CS1120.3. Differentiate between different types of operating systems – Multiprogramming systems, Time-sharing systems, Parallel systems, Real-Time systems, Distributed systems, and Mobile's systems. Compare Windows, Android, and LINUX OS with respect to their key features and functionality.

CS1120.4. Correlate basic concepts of operating system with an existing operating system.

CS1120.5. Implement and assess the performance of different types of scheduling algorithms.

CS1120.6. Examine process synchronization and Inter process communication- Race condition, semaphores, monitors; inter process communication through message passing.

CS1120.7. Categorize the conditions that cause deadlock in resource allocation. Implement deadlock-handling strategies.

CS1120.8. Analyze paging, segmentation, and segmentation with paging for VM support in memory management.

Prerequisites:

Sr. No	Specifications	Marks
01	Attendance	NIL
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report-I	NIL
09	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL

12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II (Test-2 Nos)	10+20
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus (Theory)

UNIT-1: **Introduction to OS:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, services, system calls, characteristics of OS, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Introduction to Linux, Features, Importance, History, Evolution, File handling Utilities, Administration commands. Case study on LINUX and WINDOWS Operating System.

UNIT-2: Process: Concept of process, Process states, Process State transitions, Process Control Block (PCB), Context switching, Thread: Definition, Benefits of threads, Types of threads, multithreading. Process scheduling: Foundation and Scheduling objectives, Types of Schedulers. Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. Various Scheduling algorithms (FCFS, SJF, RR, priority scheduling). Inter process communication: Critical section, Race condition, semaphores, monitors, message passing, Classical IPC Problems: Readers-Writer Problem, Dinning Philosopher Problem etc. Deadlock: Shared resources, resource allocation and scheduling, resource graph models, deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery algorithms.

UNIT-3: Memory Management: Memory management schemes, Contiguous/Non-contiguous memory allocation, storage management, paging, page table structure, segmentation, segmentation with paging, virtual memory, demand paging, page fault, and Page replacement algorithms.

UNIT-4: File System: Linux Files, Directories and Archives, The vi editor, file concept, types and structures, attributes of a file, operations performed on file, File organization and access method, file allocation methods, directory structure, file directories, directory implementation. LINUX: Overview of Linux, Essential Linux commands, Managing Users, Managing File Systems, Linux File Permissions,

UNIT-5: Advanced Operating System, Protection and security: Illustrations of security model of LINUX and other OSs. Examples of attacks.

Contents (Lab)
- Linux Operating System, components of Linux system.
- Basic LINUX commands and its Use.
- Execution of various file/directory handling commands.

- Commands related to standard I/O, Redirection, Pipes and Filters.
- Process Management Commands in Linux.
- Implementation of CPU Scheduling Algorithms.
- Implement Semaphores.
- Implement of Banker's Algorithm for Deadlock Avoidance.
- Implement the page replacement algorithms.

Text Books:
- Silberschatz, Peter B. Galvin and G. Gagne, Operating System Concepts, Wiley, 2012.
- W. Stallings. Operating Systems: Internals and design Principles, Pearson Education, 2014.
- Sumitabha Das, "Unix Concepts and Applications", TMH, 4th Ed., 2009.
- Andrew S. Tanenbaum and Herbert Bos. Modern Operating Systems, Pearson Education, 2014.

Reference Books:
- Thomas Anderson and Michael Dahlin. Operating Systems: Principles and Practice, Recursive Books, 2014.
- Richard Blum, Christine Bresnahan. Linux Command Line and Shell Scripting Bible, Wiley, 2015.
- Daniel P. Bovet, Marco Cesati. Understanding the Linux Kernel, O'Reilly media 3rd Edition, 2005.
- M. G. Venkateshmurthy. Introduction to UNIX & Shell Programming, Pearson Education, 2009.

Online References:
- https://www.cse.iitb.ac.in/~mythili/os/
- https://nptel.ac.in/courses/106/106/106106144/
- https://nptel.ac.in/courses/106/105/106105214/

Course Articulation Matrix: (Mapping of COs with POs)

CO	CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1102.1	1				1					1				1		1	
CS1102.2		1									1						1
CS1102.3			1			1		1		1							
CS1102.4															1	1	1
CS1102.5		1		1				1			1	1				1	
CS1102.6				1				1		1							
CS1102.7															1	1	
CS1102.8	1		1			1						1					1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Computational Mathematics: AS1105	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	BCA Sem II

Course Objective: This course introduces the fundamental concepts of Mathematics, related to areas such as calculus, numerical methods, mathematical logic, and linear algebra. The aim of this course is to make the students capable of problem-solving skills by building their computational thinking.

Learning Outcomes:
On successful completion of this course, the students should be able to:

AS1105.1	Model Data as matrices and find Eigen values and Eigen vectors and apply the same for problem-solving.
AS1105.2	Model complex systems as linear simultaneous equations and analyze the same using Matrix methods.
AS1105.3	Apply higher-dimensional differential calculus methods, including partial derivatives to a range of physical problems.
AS1105.4	Apply the basic numerical techniques for accurate and efficient solutions of models based on linear and nonlinear systems of equations, differential equations, etc.
AS1105.5	Use logic and proofs in order to read, comprehend and construct mathematical arguments.
AS1105.6	Apply computational approach in problem-solving in various mathematical domains

Prerequisites	**Mathematical aptitude**

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	10
4	Quiz	20
5	Theory Exam I	Nil
6	Theory Exam II	20
7	Theory Exam III	30
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	20
16	Course portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**

	Retest Evaluation Scheme	
1	Theory Exam - III	30
	Total (30)	**30**

Syllabus
Unit 1: Multivariate Calculus
Functions of two or more variables, Partial Derivatives, Total derivative, chain Rule, Euler's Theorem, Maxima-Minima of functions of two variables.
Unit 2: Linear Algebra
Matrix Operations, Eliminations, Matrix Inversion, Transformation, Solution of Linear Simultaneous Equation, Eigen Values & Eigen Vectors, Cayley-Hamilton theorem.
Unit 3: Numerical Methods
Transcendental and polynomial equation, Solutions to linear simultaneous equations, Interpolation and approximation, Numerical differentiation and integration, Solutions to ordinary differential equations.
Unit 4: Mathematical Logics
Proposition, Compound Proposition, Conjunction, Disjunction, Implication, Converse, Inverse & Contrapositive, Bi-conditional Statements, Mathematical Proof Methods.
Text Books:
1. B. S. Grewal, Higher Engineering Mathematics, 41st Ed., Khanna Publishers, Delhi, 2011.

Reference Books:

1. Kreyszig, E., Advanced Engineering Mathematics, John Willey, Delhi (2011).Potter M.C., Goldberg J.L., Edward F.A., Advanced Engineering Mathematics, 3rd Edition, Oxford University Press, 2005.
2. James Stewart, **"Calculus "**, 7th Ed., Brooks/Cole Cengage Learning, 2015.
3. Kenneth Rosen, **"Discrete Mathematics and its applications"**, 5th Ed., Tata-McGraw Hill, 2002.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
AS1105.1				1				1	2		1						
AS1105.2								1	2		1						
AS1105.3								1	2								
AS1105.4								1	2								
AS1105.5								1	1								
AS1105.6							2			2							

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	Principles of Management (IL1103)	
Hours per Week	L-T-P: 3-0-0	
Credits	3	
Students who can take	BCA II Sem.	

Course Objective- This course is designed to provide students with an overview of the management functions and its role in organizations. The course aims to provide students with the basic managerial knowledge. This course attempts to develop a "system" view of organizations.

Course Outcome:

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

IL1103.1. Evaluate the context for taking managerial actions of planning, organizing and controlling.

IL1103.2. Assess global situation, including opportunities and threats that will impact management of an organization.

IL1103.3. Specify how the managerial tasks of planning, organizing, directing and controlling can be executed in a variety of circumstances.

IL1103.4. Know and analyze how decisions are made within an organization and how those decisions are communicated to the various stakeholders.

Assessment Matrics		
Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	05
04	Quiz	15
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	40
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	10
18	Viva	Nil
	Total (100)	**100**
	Evaluation Scheme for Retest	
1	Theory Exam-III	40
	Total	40

<u>**Syllabus :**</u>

The Basis of Global Management Theory & Practice: Essentials of Management- Introduction, Nature, Purpose. Management Science or Art? Generic Functions of Management. Managerial Skills & Management Roles.
Evolution of Management Theory- Major Schools of Management Theory: Classical, Neo Classical, Behavioral and Modern school. System Approach- how it can integrate management concepts?
Management & Society- The external environment, Social responsibility & Ethics.
Planning and decision making: Nature & importance of planning, steps in planning, Objectives, evolving concept MBO, Strategic planning process, The TOWS Matrix, Porter's industry analysis, planning skills, Steps in rational decision making.
Organizing and organization structure: Nature and purpose of organizing, principles of organizing, Span of Management, Organization Structure- Departmenatation: by function, by territory, by product, by customer group. SBU, Organization structures for global environment, Choosing the pattern of departmentation.
Staffing: Overview, Importance of proper staffing, Manpower planning, recruitment, selection, placement, induction. (through cases- hiring right persons, job analysis, Getting well qualified employees).
Directing: Overview, Requirements of effective direction, Motivation and its role in directing; Leadership: overview, approaches, factors determining leadership style.
Control: Need, essential of effective control systems, steps in control process, techniques.

Text Books:
- Tripathy, P.C. and Reddy, P. N. (2012). *Principles of Management. McGraw Hill, New Delhi.*

Reference Books:
- Koontz, H. and Weihrich, H. (2010). *Essentials of Management: An International Perspective, 8e.* New Delhi: Tata McGraw Hill.
- Bateman, T. S. and Snell, S. A. (2009). *Management: Leading and Collaborating in a Competitive World, 8e.* McGraw Hill Irwin.
- Stoner, James A. F. and Freeman, R Edward. (1989) "*Management". 6th.1989. Prentice Hall of India, New Delhi.*
- Daft, R. L. (2009). *Principles of Management*. New Delhi: Cengage Learning.
- Note: Latest edition of the readings will be used.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
IL1103.1	1										2						
IL1103.2											1			1			
IL1103.3											1	2					
IL1103.4														2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Critical Thinking & Storytelling; CC1102	
Hours per Week	**L-T-P: 2-0-1**
Credits	**2**
Students who can take	B.Tech and BCA	Semester- II

Course Objectives: The modern world offers confounding opinions and choices that need to be navigated judiciously. This course explores frameworks and processes to critically examine narratives, reconstruct them, and craft well-reasoned stories that can be told using impactful communication.

Learning Outcome:
On successful completion of this course, the students should be able to:

CC1102.1   Formulate intelligent questions to investigate.
CC1102.2   Evaluate information and argument for correctness, consistency, relevance and validity.
CC1102.3   Compose well-structured and well-reasoned arguments.
CC1102.4   Articulate and evaluate the impact of narratives.
CC1102.5   Distinguish between facts, assumptions and opinion.

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	40
03	Class Participation	20
04	Quiz	NIL
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report-1	10
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	NIL
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation I (Continuous)	NIL
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
17	Presentation	NIL
18	Viva	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus

UNIT I: Introduction to Critical Thinking- Definitions of Critical Thinking, its applications and the methods to think critically. Paul & Elder model will be used.

UNIT II: Importance of questioning- The key to critical thinking is the ability to formulate intelligent questions. Students will be able to create, improve and prioritize their questions. They will be able to use different types of question by using Bloom's taxonomy to understand the root of any situation, problem or subject.

UNIT III: Examine data critically- Students will be able to filter information, separate fact from opinion, identify cognitive biases and become aware of the ladder of inference. They will also be taught to conduct responsible research and basics of bibliography and citation.

UNIT IV: Construct and reconstruct argument- Students will be taught to construct arguments with sound reasoning. They will be able to support their claims and opinions with compelling data and facts, and present well-informed arguments. Evaluate argument using logical fallacies.

UNIT V: Building a compelling narrative- Stories that we create and narrate influence how we see ourselves and our association with others. The students will be able to observe, think, create and narrate their stories in an effective manner.

Reference Books:
- **Critical thinking: an introduction**
  Alec Fisher - Cambridge University Press - 2011
- **Critical thinking its definition and assessment**
  Alec Fisher-Michael Scriven - Centre for Research in Critical Thinking - 1997
- **Art of thinking clearly**
  Rolf Dobelli - Harper Collins Usa – 2014
- **Critical thinking skills: developing effective analysis and argument**
  Stella Cottrell - Palgrave Macmillan – 2017
- **Thinking, fast and slow**
  Daniel Kahneman - Farrar, Straus and Giroux – 2015

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CC1102.1	2								1	1	2						
CC1102.2							1		1								
CC1102.3									1								
CC1102.4										1							
CC1102.5							1		1								

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**C++ Programming and Data Structures; CS1122**	
Hours per Week	**L-T-P: 3-0-4**	
Credits	**5**	
Students who can take	BCA Semester III	

Course Objective- This course aims to develop understanding for Design, Analysis, and implementation of data structures and algorithms to solve computational problems using an object-oriented programming language. Topics includes introduction to algorithms and complexity analysis (time & space), Recursion, Linear Data Structures (Arrays, Queue, Stack, linked list), Non-linear data structures (Trees, Graphs), Searching, Sorting, Indexing and Hashing.

Course Outcome:

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

CS1122.1. Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory and used by algorithms.

CS1122.2. Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs.

CS1122.3. Compare alternative implementations of data structures with respect to performance

CS1122.4. Analyze the algorithms in terms of asymptotic time and space complexity.

CS1122.5. Implement and compare various searching and sorting algorithms.

Prerequisites		Programming basics
Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	15
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	15
15	Lab Evaluation-II	15
16	Course Portfolio	Nil
	Total (100)	100

Retest

1	Theory Exam-III	30

Syllabus (Theory):

Module-1: Advanced C programming: 1-D and 2-D arrays, Pointers, handling arrays through pointers, pointer arithmetic, passing pointers as parameters to functions, pointers for inter-function communication, structures: typedef and struct keywords, dot and arrow operators, nested structs, structs containing arrays, struct containing pointers, pointer to struct, passing struct through pointers. Dynamic memory allocation, use of malloc, calloc, realloc, free. Basic file handling, pointer basics, passing pointer to variables in functions. FILE handling, opening modes, fprinf, fscanf, fread and fwrite syntax.

Module-2: Analysis of time and space complexity, Implementations and applications of elementary data structures - Stacks, Queues, Deque, linked list, binary trees, sparse matrix, Stack and queue: array-based implementation, applications. Deque using array. Link List: creation, traversal, insertion and deletion. Some simple applications of LL. Binary tree –Theory, array-based implementation, recursive tree traversals. Binary tree pointer-based storage. Sparse matrix, usages and Storages using LL. Graphs: Implementations using LL and Adjacency Matrix. Linear and binary search, insertion, selection, bubble, merge, quick sort. Heap sort. Topological sort.

Module-3: Object Oriented Programming - Concepts of Object-Orientation in C++, constructs, objects, classes, methods, constructors, function and operator overloading, inheritance, polymorphism. Introduction to SDLC. Testing fundamentals and test-case generation.

LAB
1. Write a simple C program on a 32-bit compiler to understand the concept of array storage, size of a word. The program shall be written illustrating the concept of row major and column major storage. Find the address of element and verify it with the theoretical value. Program may be written for arrays Upto 4-dimensions.
2. Simulate a stack, queue, circular queue and dequeue using a one-dimensional array as storage element. The program should implement the basic addition, deletion and traversal operations.
3. Represent a 2-variable polynomial using array. Use this representation to implement addition of polynomials.
4. Represent a sparse matrix using array. Implement addition and transposition operations using the representation.
5. Implement singly, doubly and circularly connected linked lists illustrating operations like addition at different locations, deletion from specified locations and traversal.
6. Repeat exercises 2, 3 & 4 with linked structures.
7. Implementation of binary tree with operations like addition, deletion, traversal.
8. Depth first and breadth first traversal of graphs represented using adjacency matrix and list.
9. Implementation of binary search in arrays and on linked Binary Search Tree.
10. Implementation of bubble, insertion, merge, quick, heap, topological and bubble sorting algorithms.

Text Books:

- Reema Thareja "Data Structure using C" Oxford Education, Third.2012
- Data Structures through C Yashwant Kanetkar BPB Publications Sixth 2012.

Reference Books:

- Alfred V. Aho, Jeffrey D. Ullman, John E. Hop croft, Data Structures and Algorithms. Pearson Education, 2012
- Introduction to Algorithms, Corman T.H., Leiserson, C.E., and Rivest, R.L., MIT Press, 2013. (Indian reprint: Prentice-Hall).

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1122.1						1	1		1			1				1	
CS1122.2					1	2	2				1	1		1	1	1	
CS1122.3	1					1	1		1			1				1	
CS1122.4	1				2	2	2	1	2		1	1		1	1	1	
CS1122.5					2	2	2	1	2		1	1		1	1	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Android Application Development: CS1123

Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	BCA Sem III

Course Objectives: This Course is designed to offer learners an introduction to Android platform and related applications in the real world. Learners would be introduced to android studio platform using Java. The Course lays the foundation for cross-platform app development course.

Course Outcome:

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

CS1123.1. develop high-level plans for script solutions for mobile and evaluate the post-production outcome.
CS1123.2. design scripts to meet given interface and media control requirements
CS1123.3. explain the principles of technologies which support media production and delivery on a variety of platforms.
CS1123.4. integrate Android XML resources with Java code and create complete apk file for installation.
CS1123.5. create a Google Play Store account and preparing apps for the Play Store.

Prerequisites		Java Programming
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	100
Re-Test Evaluation		
	Theory Exam-III	30
	Total:	30

Syllabus (Theory)

Module I – Mobile Application Overview
Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile Software Engineering, Design of application (view level).

Module II – Framework and User Interface Development
Frameworks and Tools, Generic UI Development, Android User (privileges), VUIs and Mobile Apps Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodial UIs, Android Intents and Services, Characteristics of Mobile Applications
Successful Mobile Development.

Module III – Storing Retrieving Data with Real-time Database
Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider, Communications Via Network and the Web, State Machine, Correct Communications Model, Android Networking and Web.

Module IV – Notifications, Alarming and Location
Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics and Multimedia, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia, Mobility and Location Based Services.

Text Books and References:
1. Android Cookbook, 2nd Edition by Ian F. Darwin Publisher: O'Reilly Media, Inc. Release Date: May 2017
2. Sam's Teach yourself Android Application Development. by Lauren Darcey and Shane Conder : 2012
3. Professional Android 4 Application Development by Reto Meier, 2012
4. Android Programming for Beginners by John Horton, 31 Dec 2015
5. https://developer.android.com/

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO-2
CS1123.1	1				1		1			1			1		1	1	1
CS1123.2		1	1					1					1	1	1	1	
CS1123.3		1		1	1				1	1	1			1			1
CS1123.4	1					1	1					1		1	1	1	2
CS1123.5				1		1	1			1		1			1		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Computer Networks and Network Administration (CS1124)	
Hours per Week	**L-T-P: 2-0-4**
Credits	**4**
Students who can take	BCA Semester III

Course Objective: The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems. This course introduces an understanding of the fundamental concepts of computer networking, layers of protocols and network technologies. This course lays the foundation for the courses on Virtualization and Cloud Computing, Applied IoT as well as Information Security.

Course Outcome:

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

CS1124.1. Build simple LANs, perform basic configurations for routers and switches, and implement IPv4 and IPv6 addressing schemes.

CS1124.2. Identify the different types of network topologies and protocols.

CS1124.3. Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

CS1124.4. Configure routers, switches, and end devices to provide access to local and remote network resources and to enable end-to-end connectivity between remote devices.

CS1124.5. Configure and troubleshoot connectivity a small network using security best practices.

CS1124.6. Evaluate the challenges in building networks and solutions to those.

Prerequisites		
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	25
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	25
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
	Total (100)	**100**

Retest		
1	Theory Exam-III	25
2	Lab Evaluation-II	10
	Total	**35**

Course Syllabus (Theory):

- **Unit I-** Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design, Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

- **Unit II-** Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

- **Unit III-** Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP, IP packet, IP address, IPv6.

- **Unit IV-** Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management.

- **Unit V-** Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Example Networks - Internet and Public Networks. Introduction to Firewall, IDS, SSH, Key Certificates, etc. Understanding Exposure Risk.

Lab Syllabus (all experiment in CISCO Packet Tracer).
Unit/ Title

1	Study of Network Devices in Detail.
2	Study of basic network command and Network configuration commands.
3	Study of different types of network cables and practically implement the cross wired cable and straight through cable using clamping tool.
4	Connect the computers in Local Area Network.
6	Study of network IP.
7	Configure a DHCP using packet tracer software.
8	Configure an FTP, HTTP and Servers using packet tracer software.
9	Configuring an Switch and Wireless Access point
10	Configuring a router and security measures in a router
11	Configuring a router for remote access with Telnet and SSH
12	Configure a Network using RIP (Distance Vector Routing protocol).
13	Configure Network using Link OSPF (State Vector Routing protocol).
14	Configure Network using ACL (Access Control List) and VLAN.

Text Books:
1. Forouzen Behrouz A., "Data Communications And Networking", Tata Mcgraw-Hill, 2nd Ed., 2000.
2. Tanenbaun Andrew S., "Computer Networks", PHI, 3rd Ed., 1998.
3. Stalling William., "Data And Computer Communications", PHI, 3rd Ed., 2000.
Reference Books:

1. Computer Networking and the Internet (5th edition), Fred Halsall, Addison Wesley
2. W. Stallings, Data and Computer Communication, Macmillan Press
3. TCP/IP Protocol Suite (6th edition), Behrouz Forouzan, McGraw Hill.

Recommended MooC:
Computer Networks - NPTEL
https://nptel.ac.in/courses/106/105/106105183/
https://nptel.ac.in/courses/106/105/106105081/

Computer Networks - SWAYAM
https://onlinecourses.swayam2.ac.in/cec20_cs01/preview
Bits and Bytes of Networking – Coursera
https://www.coursera.org/learn/computer-networking

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1124.1	1		1		1	1			1			1			1		2
CS1124.2			1			1										2	2
CS1124.3	2			1			1	1	1			1					
CS1124.4		1			1		1				2		1			2	2
CS1124.5	2					1											
CS1124.6	1			1	1		1		1		1		1		1	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Statistical Computing (AS1106)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	BCA , Semester - III

Course Objective- This course introduces fundamentals of statistics required in variety of application areas including data science. The computational analysis will include utilizing MS Excel and Python.

Course Outcome:

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

AS1106.1 Classify data and represent data using appropriate tool.

AS1106.2 Compute central tendencies and measure of variation.

AS1106.3 Compute probability.

AS1106.4 Understand basic probability distributions and solve problems using concepts of probability distributions.

AS1106.5 Compute correlation in the given data and do regression analysis.

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	15
03	Class Participation	10
04	Quiz	15
05	Theory Exam-I	20
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

Data classification, Tabulation, Presentation

Measures of Central Tendencies and dispersion: Mean, Mode, Median, Partition values, Standard Deviation, variance.

Probability: concepts of probability, definition and different approaches, axioms of probability, Conditional probability, Baye's Rule.

Probability Distributions: introduction, Random Variable, probability distribution functions, cumulative distribution function, expected values, discrete and continuous probability distributions, Binomial distribution, Poisson distribution and Normal distribution.

Correlation and Regression: Correlation, types of correlation, different methods to calculate correlation, linear and non linear regression, curve fitting, estimation.

Reference Books:
1. J. Susan Milton and Jesse C. Arnold, 'Introduction to Probability and Statistics', McGraw Hill Education.
2. VK Rohatgi and AK Saleh, 'An Introduction to Probability and Statistics', Wiley India.
3. P. Kousalya, Probability, Statistics and Random Processes, Pearson.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES													CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
AS1106.1					1	1	1	1				1	1				
AS1106.2					1	1	1	1		1	1	1	1				
AS1106.3	1				1	1											
AS1106.4					1							1					
AS1106.5					1	1	1	1		2	1	1	2	1	1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Economics and Accounting (IL1104)	
Hours per Week	**L-T-P: 3-0-0**
Credits	**3**
Students who can take	BCA III Sem.

Course Objective- This course will prepare students to understand business from the perspective of economics and accounting. Economics will impart knowledge towards use of limited resources in decision making while accounting will help to understand the basic financial statements and concepts to perform analysis.

Course Outcome:
On successful completion of this course, the students should be able to:

IL1104.1. Apply the fundamental economic concepts, theories of economic analysis for decision making.

IL1104.2. Comprehend the sales, output, pricing and market strategies against the dynamic business environment in different market structures.

IL1104.3. Apply the various macroeconomic variables/ concepts and their interlinkages with each other.

IL1104.4. Identify and distinguish the mechanism for recording, classifying and summarizing business transactions.

IL1104.5 Develop competency for the preparation of the financial statements of a corporate enterprise – Balance Sheet, Statement of Profit and Loss.

IL1104.6. Analyze and interpret financial statements by performing financial ratio analysis.

Assessment Matrics		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	NIL
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	10
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	20
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Syllabus :
Module I (Economics)

- Basic economic terms
- Working of an economy
- Laws of Demand and Supply and market Equilibrium
- Elasticity of demand and its application
- Production function
- Concepts of cost and revenue
- Price and output determination under different Market Structures

- Measurement National Income
- Major Macroeconomics concepts

Module II (Accounting)

- Financial Accounting Framework
- Preparation of Key Financial Statements
- Financial Statement Analysis
- Digital Accounting

Text Books:
- **T1:** Dwivedi, D. N. (2009). Principles of Economics, Vikas Publishing House Pvt Ltd.
- **T2:** Narayanaswamy, R. (2014). Financial Accounting – A managerial perspective (6th edition), PHI Learning Private Limited.

Reference Books:
- T.R. Jain and M.L. Grover. Economics for Engineers, V. K. (India) Enterprises
- G. Mankiew. Economics Principles and Applications. Cengage Learning
- Horngreen, T. Charles, Sundem, L.Gary, Elliott, A. John, Philbrick and R. Donna.(2019). Introduction to Financial Accounting, 11/e, Pearson Publication, New Delhi.
- Bhattacharya, K. Asish.(2016). Financial Accounting for Business Managers. New Delhi. PHI Publication.
- Kulkarni Mahesh and Mahajan Suhash.(2016). Accounting for Business Decissions, 2/e, Nirali Prakashan, New Delhi.
- Ambrish, Gupta (2019). Financial accounting for management: An analytical perspective, 5/e. New Delhi: Pearson Education.
- Khatri K. Dhanesh. (2018). Financial Accounting,1/e. New Delhi: Mc Graw Hill Education Pvt. Ltd.
- Gabriel, John,S. and Marcus A. (2017). Financial Accounting, 3/e. New Delhi: Mc Graw Hill Education Pvt. Ltd.
- Rajasekaran V. and Lalitha R.(2018). Financial Accounting, 1/e. New Delhi: Derling Kindersey (India) Pvt. Ltd, Licensess of Pearson Education in SouthAsia.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
IL1104.1	2													2			
IL1104.2	1										1						
IL1104.3	1										1			1	1		
IL1104.4											1						
IL1104.5											1						
IL1104.6										2				1	1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Perspectives on Contemporary Issues (CC1103)		
Hours per Week	**L-T-P: 2-0-1**	
Credits	**2**	
Students who can take	B.Tech-BCASem III	

Course Objective-

In an era of globalization, there is an increasing need for the youth to be able to empathize with others, value diverse perspectives and cultures and understand how events around the world are intertwined. Global issues revolve around social, economic and environmental factors which ultimately add to the interconnectedness of countries. In this course, students will employ key critical thinking concepts to analyze contemporary issues from multiple perspectives. They will explore the impact at micro and macro levels.

Course Outcome:

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

CC1103.1: Identify different perspectives objectively.

CC1103.2: Explain interconnectedness of the issues and their impact at micro and macro levels.

CC1103.3: Recognize their own beliefs, biases, claims and assumptions.

CC1103.4: Evaluate sources, argue and defend effectively.

Prerequisites		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	20
03	Class Participation	30
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	20
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

Research, analysis & evaluation of a topic from local, national and global perspectives.

➢ **Globalization**

With increasing development throughout the world, the focus of this theme will be on the impact of adopting policy of neoliberalism globally. Changes in India after implementation of new economic policy of 1991.

> **Poverty and Inequality**

What do you mean by wealth & equality? Is it enough to ascribe monetary values
to human lives? Who has benefited from an increased access to resources,
labour & capital due to globalisation? Which groups are historically marginalised &   suffer
from unequal access to opportunities

> **Social justice and human rights**

An understanding of the impact of inequality and discrimination, the importance of standing up for
our own rights and our responsibility to respect the rights of others.

> **Climate Change and Sustainability**

Understanding the magnitude of the issue, its impact and future challenges. How we can meet our
current needs without diminishing the quality of the environment or reducing the capacity of future
generations to meet their own needs.

> **Technology**

Impact of unprecedented technological growth, challenges and opportunities. Is technocracy a boon
or a bane?

References for reading:
1. Harari, Y. N. (2019). 21 Lessons for the 21st century. Toronto: CELA.
2. Guha, R. (2019). India After Gandhi: the history of the world's largest democracy. NEW YORK: ECCO.
3. Rosling, H., Rosling, O., & Rönnlund Anna Rosling. (2019). Factfulness: ten reasons were wrong about
the world - and why things are better than you think. London: Sceptre.
4. Kolbert, E. (2015). The Sixth Extinction: An unnatural History.

5. https://www.downtoearth.org.in/blog/governance/mass-poverty-is-back-in-india-76348

6. https://geographyandyou.com/indias-poverty-line-changing-perspectives/

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CC1103.1	2	1	1								1		1				
CC1103.2			1						1								
CC1103.3		2	1						1				2				
CC1103.4										2							

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Algorithm Design and Analysis

Course Title and Code: **Algorithm Design and Analysis (CS1126)**	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4 (CSE)**

Course Objective:
This course introduces an understanding of the design and analysis of algorithms. The course aims to develop a familiarity with important algorithms and data structures and an ability to analyze the asymptotic performance of algorithms. It will equip the students to apply important algorithmic design paradigms and methods of analysis to develop efficient algorithms in common engineering design situations.

Course Outcome:
On successful completion of this course, the students should be able to:

CS1126.1.   Analyze the complexity of different algorithms using asymptotic analysis.
CS1126.2.   Analyze and select an appropriate data structure for a computing problem.
CS1126.3.   Differentiate and apply different algorithm designs technique: Divide and Conquer Technique, Greedy and Dynamic Programming.
CS1126.4.   Develop algorithm and programs using Divide and Conquer technique to solve various computing problems.
CS1126.5.   Develop algorithms and programs using Greedy and Dynamic Programming technique to solve various computing problems.

Prerequisites: Programming

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	10
05	Theory Exam– 1	Nil
06	Theory Exam – 2	10
07	Theory Exam–3	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation (Continuous)	15
15	Lab Evaluation (Exam)	15
16	Course portfolio	Nil
17	Presentation	5
18	Viva	5
	Total (100)	100

Retest Evaluation Scheme		
1	Theory Exam–3	20
2	Lab Evaluation (Exam)	15
	Total (35)	35

Syllabus (Theory):

UNIT I: Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Types of approaches.

UNIT II: Selection sort, Bubble sort, Insertion Sort, Shell sort, Quick sort, Merge sort, Heap sort, sorting in linear time: Radix sort, Counting Sort, Comparison of sorting algorithms, Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching. BFS, DFS, Topological sort.

UNIT III: Greedy methods, Elements of Greedy Strategy, Activity Selection Problem, Huffman Codes, Matroids Task Scheduling, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single-source shortest paths - Dijkstra's and Bellman-Ford algorithms.

UNIT IV: Dynamic programming, Elements of Dynamic Programming, Matrix Chain Multiplication, Longest Common Subsequence, Optimal Polygon Triangulation, all pair shortest paths – Warshall's and Floyd's algorithms.

Text Book(s)
1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Prentice Hall of India. 2002

Reference Book(s)
1. RCT Lee, SS Tseng, RC Chang and YT Tsai. Introduction to the Design and Analysis of Algorithms. Mc Graw Hill, 2005.
2. E. Horowitz & S Sahni. Fundamentals of Computer Algorithms. 1984
3. Berman, Paul. Algorithms. Cengage Learning. 2002
4. Aho, Hopcraft, Ullman, The Design and Analysis of Computer Algorithms. Pearson Education, 2008.

Syllabus (Practical):

1. **SEARCHING AND SORTING BASED PROBLEMS**
    I.   Implement an algorithm to find an element in a matrix in which each row and each column is sorted.
    II.   Implement an efficient algorithm to find a majority element in an array. A majority element is one whose number of occurrences is more than half the size of the array.
    III. Given an array [a1 to an] construct another array [b1 to bn] where bi = a1*a2*...*an/ai. You are allowed to use only constant space and the time complexity is O(n). No divisions are allowed
    IV.   Implement the following sorting algorithms: Insertion, Selection, Bubble.

2. **DIVIDE AND CONQUER**
    I.   Write a program to implement quick merge sort using recursive procedures.
    II.   To implement finding greatest common divisor between two positive integers.
    III. To implement Matrix Multiplication and analyze its time complexity.

3. GREEDY AND DYNAMIC PROGRAMMING
    I.   To implement Longest Common Subsequence problem and analyze its time complexity.
    II.   To implement Dijkstra's algorithm and analyze its time complexity.

NPTEL Swayam Course:

1. https://nptel.ac.in/courses/106/106/106106127/
2. https://nptel.ac.in/courses/106/102/106102064/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

CO		CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
		PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1126.1							1	1		1			1				1	
CS1126.2						1	1	1				1	1		1	1		
CS1126.3		1					1	1		1			1				1	
CS1126.4		1				1	1		1	1		1	1		1	1	1	
CS1126.5						1	1	1	2	2		1	1		1	1	1	

Course Title and Code: Robotic Process Automation Lab (CS1125)	
Hours per Week	**L-T-P: 0-0-4**
Credits	**2**
Students who can take	BCA Sem IV

Course Objective- The course aim is to develop understanding about Intelligent Automation through Robotic Process Automation for automating business processes using software robots with cost efficient digital delivery.

Course Outcome:

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

CS1125.1 Use and understand the various functionalities and features of UiPath Studio and Orchestrator.
CS1125.2 Design, implement, and use RPA activities.
CS1125.3 Develop basic robots using UiPath Community Edition.
CS1125.4 Explore various data extraction techniques.
CS1125.5 Identify processes which can be automated.
CS1125.6 Apply best practices in RPA projects.

Prerequisites		Basic Programming Skills
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	Nil
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I(Implementation)	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Test)	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	10
17	Presentation	5
18	Viva	10
	Total (100)	**100**

Retest

1	Quiz	20
2	Lab Evaluation-I (Test)	20

Syllabus (Theory):

Unit I: Programming Basic & Recap: Programming concept basic; **Introduction to RPA:** scopes and techniques of automation, RPA components and various RPA platforms, Introduction to UiPath as RPA platform, Applications and Benefits of RPA, Introduction to UiPath Studio, UiPath robot, types of robots, and UiPath Orchestrator. Brief on Studio interface and components.

Unit II: **RPA Projects:** Types of Projects in RPA: Sequence, Flowcharts, and State machines; Variables, Arguments, Data Types and Control flow: flow chart activities and sequences activities. **Data Manipulation:** Text and Data Manipulation**,** Data tables, clipboard management, file operation, importing from and exporting to CSV/Excel file and data table.

Unit III: **Control of Controls:** Attach window activity, Finding the control, Waiting for a control, Act on Control- mouse and keyboard activity. Handling event driven controls as working with UiExplorer handling events. Introduction to Recorder, OCR, types of OCR and Screen Scrapping Using OCR. **Selectors:** Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.

Unit IV: **Application with Plugins and Extensions:** Java plugins, Citrix automation, Mail plugins, PDF plugins, Web integration, excel and word plugins. Extensions- Java, chrome, firefox, and Silverlight. **UiPath Advanced Automation concepts and techniques:** Image, Text and introduction of Citrix Automation; **Excel Data Tables & PDF:** Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors. **Email Automation:** Incoming Email automation, Sending Email automation.

Unit V: **Debugging and Exception Handling:** Common exceptions and ways to tackle them, Strategies for solving issues, Catching errors **Capstone Project.**

LAB
1. Setup, configuration, and introduction of components of UiPath Studio.
2. Execution of prebuilt examples of sequence, flow chart and state machines projects.

Create a sequence/Flow chart activity defining various types of variable as:

3. Generic Value Variables, Text Variables, Boolean Variables, Number Variables,
4. Array Variables, Date and Time Variables, Data Table Variables

Managing Arguments:

5. Create two activities, one activity defined with arguments and second activity which manages the argument to receive value from first activity.
6. Create an activity to manage importing active namespaces.

Create a project to Manage the control Flow:

7. The Assign Activity, The Delay Activity, The Do While Activity, The If Activity
8. The Switch Activity, The While Activity, The For-Each Activity, The Break Activity.

The Recording toolbar Activity:

9. Exercises using basic, web, and Desktop recoding.
10. Automate manual recording projects on Left-click on buttons, check boxes, drop-down lists, GUI elements, and Text typing

Data Scrapping:

11. Bot to extract structured data from your browser, application or document to a database, .csv file or even Excel spreadsheet.
12. Image and Text Automation
13. Excel Data Tables & PDF
14. Email Automation
15. Deployment of plugins and extensions.
16. Deploying and maintaining the BOT.

Text Material & Resources:
Text Books:
T1   Tripathi, Alok Mani. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool–UiPath. Packt Publishing Ltd, 2018.
T2. Murdoch, Richard. "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant." Middletown, DE. Omakustanne (2018).

Reference Books:
R1. Abhinav Sabharwal, "Introduction To RPA", Independently Published Kindle Edition on Amazon Asia-Pacific Holdings Private Limited, 201 8
R2. Gerardus Blokdyk, "RPA Robotic Process Automation", 5Starcook, Second Edition, 2018
R3. Kelly Wibbenmeyer, "The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization" Paperback, iUniverse, 2018
R4. Willcocks, Leslie P., Mary Lacity, and Andrew Craig. "The IT function and robotic process automation." (2015).

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CS1125.1	1																1
CS1125.2						1										1	1
CS1125.3	1				1											1	1
CS1125.4																2	
CS1125.5					1					1				1		2	2
CS1125.6						1	1									2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Applied IoT (EE1117)	
Hours per Week	**L-T-P: 0-0-4**
Credits	**2**
Students who can take	BCA Semester IV

Course Objective- The course aims to develop understanding of Internet of Things concepts and also develop skills for working on IoT development boards to interface sensors and actuators. The course will enable the students to upload data from sensors on a web server and to use this data for analytical purposes or to actuate some transducers.

Course Outcome:

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

EE1117.1   Interface the Analog and Digital sensors to Node-MCU.

EE1117.2   Develop Embedded C programs to read sensor data and upload to public cloud platform.

EE1117.3   Use Python-based IDE (integrated development environments) for the interfacing of I/O devices with Raspberry Pi.

EE1117.4   Visualize sensor data uploaded on public cloud.

EE1117.5   Apply standard protocol(s) for implementation of IoT Systems.

EE1117.6   Analyse and improve existing systems with innovative IoT based approaches.

Prerequisites		Basic Programming
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report-I	Included in Project 1
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Continuous)	30
15	Lab Evaluation-II	25
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**

Retest

1	Theory Exam-III	Nil
2	Lab Evaluation-II	25
	Total (25)	**25**

Syllabus (Theory):
UNIT 1: Introduction to IoT Fundamentals: Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking.
UNIT 2: Sensors and Actuators: Sensors and Transducers, Sensor Classes, Sensor Types, Actuator Basics, Actuator Types,
UNIT 3: Basics of IoT Networking & Protocol: IoT Components, Inter-dependencies, Protocol Classification, HTTP, MQTT.
UNIT 4**:** Introduction to NodeMCU and Server: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Interfacing different sensors with NodeMCU. Introductio to Blynk App, Uploading and downloading data from server using Blynk App. Intoduction to ThingSpeak Server, Uploading and downloading data from ThingSpeak server.
UNIT-5 Raspberry Pi: Basic functionality of the Raspberry Pi B+ board, Setup and Configuring Raspberry Pi, programming on the Raspberry Pi using Python, Python functions to access the Raspberry Pins, Raspberry Pi with online cloud services.

Reference Books:
1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. IoT fundamentals: networking technologies, protocols, and use cases for the internet of things : Hanes, David | Salgueiro, Gonzalo | Grossetete, Patrick | Barton, Robert Henry, Jerome, Pearson, 2018, ISBN: 9789386873743.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter.

Video lectures:
1. Introduction to internet of things By Prof. Sudip Misra, IIT Kharagpur

https://swayam.gov.in/nd1_noc20_cs66/preview

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1117.1								1		1							
EE1117.2						1	1	1									
EE1117.3								1		1							
EE1117.4						1		1	1	1	1		1	1			
EE1117.5						1	1		1	1							
EE1117.6						1			1	1			1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Virtualisation and Cloud Computing (CS1127)**
Hours per Week	L-T-P: 2-0-4
Credits	4
Students who can take	BCA Sem VI (2020-2023)

Course Objective:
This course introduces a broad spectrum of components that comprise virtualization and cloud computing. The student will learn about the technologies involved with these components and how they relate to each other to form a virtualization/cloud architecture based on well-known practices. This course builds upon the Operating System, Computer Networks, Database, Computer Architecture.

Course Outcomes:
On successful completion of this course, the students should be able to:

CS1127.1   Create Virtual Machines (VM) using Hypervisors, install Kali Linux on the VM and demonstrate IaaS, PaaS and SaaS through real life examples

CS1127.2   Build and deploy cloud applications that are resilient, elastic and cost-efficient

CS1127.3   Analyse the trade-offs between deploying applications in the cloud and over the local infrastructure.

CS1127.4   Deploy applications over commercial cloud computing infrastructures, i.e., Google Cloud

CS1127.5   Analyse the performance, scalability, and availability of the underlying cloud technologies and software

Prerequisites	Operating System, Computer Networks, Database, Computer Architecture

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	20
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	15
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	100

Evaluation Scheme for Retest

1	Lab Evaluation-I	15
2	Theory Exam-III	20
	Total	35

Syllabus:
Virtualization, Concept, Types of Virtualization, Full Virtualization, Hardware-assisted Virtualization, Partial Virtualization, Paravirtualization, OS-level Virtualization
Hypervisor, Type of Hypervisor, Snapshot (storage), Migration, Application Virtualization, Portable Application, Memory Virtualization, Storage Virtualization, Network Virtualization, Software-defined Networking, Network-function Virtualization
Cloud Computing Overview: Definition and evolution of Cloud Computing, Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks and Use Cases, Benefits, Risks, and Challenges of Cloud Computing, Economic Models and SLAs, Topics in Cloud Security
Cloud Infrastructure: Historical Perspective of Data Centres, Datacentre Components: IT Equipment and Facilities, Design Considerations: Requirements, Power, Efficiency, & Redundancy, Power Calculations, PUE and Challenges in Cloud Data Centres, Cloud Management and Cloud Software Deployment Considerations
Overview of Google Cloud Platform Fundamentals: Google App Engine, Google Compute Engine, Google Kubernetes Engine, Google Cloud Storage, Google Cloud SQL, and BigQuery, Google Cloud Resource Manager hierarchy and Google Cloud Identity and Access Management, infrastructure design, and virtual networking configuration with Virtual Private Cloud (VPC), Projects, Networks, Subnetworks, IP addresses, Routes, and Firewall rules

Reference(s)
Nhu Gia Nguyen, Dac-Nhuong Le, Jyotir Moy Chatterjee, Raghvendra Kumar, Cloud Computing and Virtualization. Wiley
Thomas Erl, Ricardo Puttini, Zaigham Mahmood. Cloud Computing: Concepts, Technology & Architecture. Pearson, 2013.
Michael J. Kavis. Architecting the Cloud: Design Decisions for Cloud Computing Service Models. Wiley, 2014.
MOOC on Cloud Computing and Virtualization: An Introduction, Udemy, https://www.udemy.com/course/cloud-computing-and-virtualization-an-introduction/

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes														Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CS1127.1		1		1		1	1	1								1	
CS1127.2	1					2					2			2			2
CS1127.3				1			2	2	1	1		2	1			1	
CS1127.4								1		1						2	2
CS1127.5								1		1		1	2			2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Communication and Identity (CC1104)	
Hours per Week	**L-T-P: 2-0-1**
Credits	**2**
Students who can take	B.Tech/BCA/BBA/B.Des Semester- IV

Course Objectives: This course enables students to explore their identities to mark their distinctive presence in professional spaces. It intends to help them gain an understanding of the basic purpose, benefits, and responsibilities of self-presence, and to begin the process of defining their values, strengths, and goals, which helps them enhancing their employability skills through exposing themselves through various activities.

Course Outcomes:
On successful completion of this course, the students should be able to:

CC1104.1   Analyze their personal identities by identifying their personal attributes, values, strengths, and vision statement.

CC1104.2   Articulate their personal statement and use it to craft an influential pitch.

CC1104.3   Express themselves professionally on various social media platforms.

CC1104.4   Write a well-structured professional business document.

	Evaluation Scheme	
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	40
03	Class Participation	30
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation I (Continuous)	Nil
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**

Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Course Topics

Module(s)	Topics to be covered
Identifying Self	Discovering Identities: Words That Describe Me, Your Personal Identity, A Portrait of Yourself, Personal Identity Wheel, Self-Awareness from five aspects that influence our identity - Personal Attributes, Value and Principles, Emotional Awareness, Tendencies and Habit, Needs Assessment.
	Personal Branding: Meaning, Importance and how to create and use it; Identify, Build and Market your brand story.
Persuasive Communication	Personal Brand Statement, Resume, Cover Letter and The Elevator Pitch, Presence in Group Discussion and Personal Interviews
	Online Brand Communications- Creating an online presence for professional branding on social media platforms (LinkedIn, Facebook, Instagram, etc)
	Writing a well-structured and effective business documents (Agenda, Minutes of the meetings (MoM) Emails, Executive Summary)

Referred MOOCs –
Course Name- Introduction to Personal Branding
Course duration - approx. 7 hours
Offered by University of Virginia
https://www.coursera.org/learn/personal-branding

Course Name- Digital Footprint (If I Googled you, what would I find?)
Course duration - approx. 9 hours
Offered by The University of Edinburgh
https://www.coursera.org/learn/digital-footprint

COURSE NAME- HIGH IMPACT BUSINESS WRITING

Course duration - approx. 7 hours
Offered by University of California, Irvine
https://www.coursera.org/learn/business-writing

Referred Books -
- Garner, B. A. (2012). HBR Guide to Better Business Writing. United States: Harvard Business Review Press.
- Westfall, C. (2012). The New Elevator Pitch. United States: Marie Street Press.
- Arruda, W., Dixson, K. (2010). Career Distinction: Stand Out by Building Your Brand. Germany: Wiley.
- Hedges, K. (2017). The Power of Presence: Unlock Your Potential to Influence and Engage Others. United States: AMACOM.
- Lacy, K., Deckers, E. (2012). Branding Yourself: How to Use Social Media to Invent Or Reinvent Yourself. United Kingdom: Pearson Education.

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1104.1								2						1			
CC1104.2														2			
CC1104.3											2			1			
CC1104.4											1			2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Cyber Security (EE1219)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.C.A. IV semester, B. Tech VI semester

Course Objectives- This course introduces the NIST Cybersecurity framework and sensitizes the students on security risks, malware and social engineering attacks. It builds skills for ensuring good cyber hygiene, monitoring and reporting cyber-attacks for an online computer.

Learning Outcome:
On successful completion of this course, the students should be able to:
  EE1219.1. Recommend the implementation tier for the NIST framework for a specific organization.
  EE1219.2 Detect malicious attempts in a network using network sniffers
  EE 1219.3 Analyze network and application attacks using SIEM.
  EE1219.4 Appreciate the significance of cyber forensics and carry stages of forensic investigation by taking memory backups, data recovery, analyzing registry, traffic logs etc.
  EE1219.5 Apply SQL injection, Cross-site script hacking, and other ethical hacking on virtual boxes and understand how hackers work.
  EE1219.6 Use automation tools for threat intelligence perception.

Prerequisites: Nil
Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	05
3	Class Participation	Nil
4	Quiz	15
5	Theory Exam-I	Nil
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I (Scenario on Network Security)	10
12	Project-II (Scenario on Forensic)	10
13	Project-III (Scenario on Ethical Hacking)	10
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	100

Retest

1	Theory Exam III	30
	Scenario (any one)	10
	Total	40

Course Contents:

Module 1: Introduction to NIST framework, Organization functions, CyberSeek, Types of Cyber Attacks, Vulnerabilities, Risks and Exploits, Overview of zero trust.
Network and Application Security- Intrusion Detection systems (IDS), Intrusion Prevention systems (IPS), Security Information and Event Management (SIEM) log analysis- using Splunk, Snort, Demilitarized zones (DMZ), Honeypots in network. Monitoring cyberattacks using SIEM for DOS, SQLi, XXS, XXE, LFi, Command Injection, identifying False Positive and False Negatives in SIEM logs. **Authentication Protocols** -Lightweight Directory Access Protocol, Kerberos, New Technology LAN manager (NTLM), Active Directory Domain Service (AD DS).
Module 2- Forensic - Introduction, Benefits and Challenges of Digital Forensic, Methodology, setting up Forensic workstation, NIST catalog for searching forensic tools and techniques, Computer, Registry, Mobile forensic tools, difference between Digital and Electronic Forensic, Hands-on using tools-Autopsy, Scalpel and Binwalk for data carving, extracting Botnet from memory, RAM triage., Network Miner and Wireshark for traffic analysis, Registry acquisition using FTK Imager, Shellbag explorer ,Registry viewer. Anti-forensic methods, Steganography tools-Openstego.
Module 3: **Ethical Hacking -**White hat hackers, Big bounty programs, familiarization with Common Vulnerabilities and Exploits (CVE), Nmap to locate attack vectors, Metasploit framework, Burp Suite for automated scanning. **Threat Intelligence -**Attackers vs Defenders, TI cycle, Online Anonymity, Trend analysis-Webscapper, Elastic search, Monitoring and alerting.

Text Books:

1. Introduction to Cybersecurity: Guide to World of Cybersecurity-Anand Shinde, Notionpress, India
2. Cryptography and Network security-Atul Kahate, Second Edition, Tata Mc Graw Hill.

Online Resources:

1. **https://www.nist.gov/cyberframework**
2. **https://www.cyberseek.org/**
3. **https://www.wireshark.org/**
4. **https://www.splunk.com/en_us/download**
5. **https://www.volatilityfoundation.org/**

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes														Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
EE1219.1.	1			2								2					2
EE1219.2.						1			2							2	
EE1219.3.						1			2							2	
EE1219.4	2		1			1				1						2	
EE1219.5.			1							2							1
EE1219.6	2														2		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Program Articulation Matrix (BCA) 2021-24

S.No.	Course Code	Course Title	Credit	Year	Semester	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
1	CS1115	Problem Solving with Python	5	1	I	0	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.1	0.4	0.3	0.1	0.1	0.2	0.4	0.3
2	CS1116	Database Management and Applications	5	1	I	0.6	0.1	0.1	0.2	0.3	0.3	0.3	0.1	0.1	0.3	0.2	0.3	0.2	0.3	0	0.4	0.3
3	AS1104	Mathematics	4	1	I	0.4	0	0	0	0	0.6	0.4	0	0	0	0	0	0	0	0	0	0
4	CS1117	Computer Organisation and Systems	4	1	I	0.3	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.1	0.1	0.3	0.3	0	0.3	0.4	0.3	0.6
5	CC1101	Fundamentals of Communication	2	1	I	0.2	0	0	0	0	0	0	0	0	0	0.286	0	0.57	0	0	0	0
6	CS1118	JAVA Programming	5	1	II	0.2	0	0	0.4	0.6	0.8	1	0.8	0.4	0	0.2	0.2	0	0.2	0	0.2	0
7	CS1119	Web Application Development	4	1	II	0.29	0.57	0	0.29	0.29	0.29	0.29	0	0	0.29	0.14	0.29	0.14	0	0.14	0.29	0.14
8	AS1105	Computational Mathematics	4	1	II	0	0	0.17	0	0	0.33	0.88	1.5	0.33	0.33	0	0	0	0	0	0	0
9	CS1120	Operating Systems and Linux Administration	4	1	II	0.25	0.25	0.25	0.25	0.125	0.25	0	0.375	0	0.375	0.25	0.125	0.13	0.125	0.25	0.5	0.375
10	IL1103	Principles of Management	3	1	II	0.25	0	0	0	0	0	0	0	0	0	0	0	0.5	0.25	0	0	0
11	CC1102	Critical Thinking & Storytelling	2	1	II	0	0	0.5	0	0	0.25	0	0.25	0	0	0.25	0	0.75	0	0	0	0
12	CS1122	C++ Programming and Data Structures	5	2	III	0.40	0.00	0.00	0.00	1.00	1.60	1.60	0.40	1.20	0.00	0.60	1.00	0.00	0.60	0.60	1.00	0.00
13	CS1123	Android Application Development	4	2	III	0.40	0.40	0.20	0.40	0.40	0.20	0.60	0.40	0.20	0.60	0.20	0.40	0.40	0.60	0.80	0.60	1.00
14	AS1106	Statistical Computing	4	2	III	0.20	0.00	0.00	0.00	0.80	1.00	0.60	0.60	0.00	0.60	0.40	0.80	0.80	0.20	0.20	0.00	0.00
15	CS1124	Administration	4	2	III	1.00	0.17	0.33	0.33	0.50	0.33	0.50	0.17	0.50	0.17	0.17	0.50	0.33	0.17	0.33	1.00	1.33
16	IL1104	Economics and Accounting	3	2	III	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.67	0.00	0.00	0.67	0.33	0.00	0.00
17	CC1103	Perspectives on Contemporary Issues	2	2	III	0.50	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.25	0.00	0.75	0.00	0.00	0.00	0.00
18	CS1126	Algorithm Design and Analysis	4	2	IV	0.40	0.00	0.00	0.00	0.60	1.00	0.80	0.60	1.00	0.00	0.60	1.00	0.00	0.60	0.60	0.80	0.00
19	CS1125	Robotic Process Automation Lab	2	2	IV	0.33	0.00	0.00	0.00	0.33	0.33	0.17	0.00	0.00	0.17	0.00	0.00	0.00	0.17	0.00	1.00	1.00
20	EE1117	Applied IoT	2	2	IV	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.83	0.50	0.83	0.33	0.00	0.33	0.33	0.20	0.00	0.00
21	CS1127	Virtualisation and Cloud computing	4	2	IV	0.20	0.20	0.20	0.40	0.00	0.60	0.60	1.00	0.20	0.60	0.40	0.60	0.60	0.40	0.00	1.20	1.00
22	EE1219	Cybersecurity	4	2	IV	0.50	0.00	0.20	0.20	0.00	0.30	0.00	0.00	0.40	0.20	0.10	0.00	0.20	0.00	0.20	0.60	0.40
23	CC1104	Communication and Identity	2	2	IV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	1.00	0.00	2.00	0.00	0.00	0.00	0.19
					Total	7.0897	2.84	2.8	2.77	5.348	8.9163	8.42	8.49467	5.83	5.498	6.746	6.315	7.8	5.012	4.053	8.29	6.6325
		Desired Competence Level (N- Novice, AB- Advanced Biginner, C- Competent				N	N	N	N	N	AB	AB	AB	N	N	N	N	N	N	N	AB	N

Note: The courses to be taught in Sem 5 and Sem 6 will be included in this table later.

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