BANKURA UNIVERSITY

Curriculum and Credit Framework for

BCA Programme

(Semester-I, Semester-II, Semester-III and Semester-IV)

PROVISIONAL

(Basic, Honours and Honours with Research)

designed in accordance with

Learning Outcomes-Based Curriculum Framework (LOCF)
of National Education Policy (NEP)-2020

SYLLABUS

With Effect from the Session 2023-2024

BANKURA UNIVERSITY

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(Basic, Honours and Honours with Research)

Preamble:

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system for improving and upgrading the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes in undergraduate program in professional streams of higher education like computer science. One of the significant reforms in the undergraduate education is to introduce the Learning Outcomes-based Curriculum Framework (LOCF) which makes it student- centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the country which will help the students to ensure similar quality of education irrespective of the institute and location. With initiatives of University Grants Commission (UGC) for nation-wide adoption and implementation of the LOCF for bachelor's programmes in colleges, universities and HEIs in general. So BCA Programme at Bankura University is designed as per LOCF & and NEP-2020 as per UGC guidelines.

The main objective of BCA Programme program at Bankura University is to prepare a comprehensive course structure with detailed syllabus along with quality reading material in order to have a uniform standard of education in BCA Programme among students. This document shall serve as a model document across the higher education institutes (HEIs) in the country for teachers, students and academic administrators. It is a student centric framework where they are expected to learn fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, .NET Technologies, Digital Image Processing, Data Warehousing and Data Mining along with advanced skillsets that include Mobile Application Development, Object Oriented Programming among many other courses. It will help the students to be equipped with fundamental as well as advanced and latest technologies in computer science after completion of the programme

Introduction:

BCA Programme has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. BCA Programme is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. BCA Programme can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain.

BCA Programme has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. BCA Programme is practised by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

BANKURA UNIVERSITY

Bankura University has started BCA Programme in the year 2018, as this discipline evolved itself to a multidisciplinary discipline. Information Technology is growing rapidly. Increasing applications of computers in almost all areas of human endeavor has led to vibrant industries with concurrent rapid change in technology. Unlike other basic disciplines, developing core competency in this discipline that can be reasonably stable becomes a challenge.

Career Objective:

BCA Programme are aimed at undergraduate level training facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in Computer Science/Computer Application leading to research as well as R&D, can be employable at IT industries, or can pursue a teachers' training programme such B. Ed. in Computer Application, or can adopt a business management career. BCA Programme aims at laying a strong foundation of Computer Application at an early stage of the career. There are several employment opportunities and after successful completion of an undergraduate programme in BCA Programme, graduating students can fetch employment directly in companies as Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

The Learning Outcome-based Curriculum Framework in BCA Programme is aimed at allowing flexibility and innovation in design and development of course content, in method of imparting training, in teachinglearning process and in assessment procedures of the learning outcomes. The emphasis in BCA Programme course, in outcome-based curriculum framework, help students learn solving problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages.

Many of the learning outcomes of BCA Programme can be achieved only by programming a computer for several different meaningful purposes. All students must, therefore, have access to a computer with a modern programming language installed. The computer science framework does not prescribe a specific language. The teacher and students will decide which modern programming languages students will learn. More importantly, students will learn to adapt to changes in programming languages and learn new languages as they are developed.

- The present Learning Outcome-based Curriculum Framework for BCA Programme is intended to facilitate the students to achieve the following.
- To develop an understanding and knowledge of the basic theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation.
- To develop the ability to use this knowledge to analyse new situations.
- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems.
- To learn skills and tools like mathematics, statistics, physics and electronics to find the solution, interpret the results and make predictions for the future developments.

BANKURA UNIVERSITY

Curriculum Planning- Learning Outcomes-based Approach for BCA Programme:

BCA Programme is generally a three-year degree program which develops advanced theoretical and research skills in subject. This programme helps in building an advanced professional or academic career. It is an appropriate course for students who wish to pursue a MCA, M. Sc. (Computer Science), MBA or Doctor of Philosophy (PhD) in CS and a research or academic career. This program facilitates students who wish to pursue an independent research project in an area of interest under the supervision of an academic

Aims of BCA Programme:

The BCA Programme emphasizes problem solving in the context of algorithm development and software implementation and prepares students for effectively using modern computer systems in various applications. The curriculum provides required BCA Programme courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering; as well as elective courses in artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other current topics in computer science. The main aim of this Bachelor's degree is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners.

The purpose of the BCA Programme programs in are twofold:

(1) to prepare the student for a position involving the design, development and implementation of computer software/hardware, and

(2) to prepare the student for entry into a program of postgraduate study in computer science/engineering and related fields.

BCA Programme focus on the concepts and techniques used in the design and development of software systems. Students in this program explore the conceptual underpinnings of Computer Science -- its fundamental algorithms, programming languages, operating systems, and software engineering techniques. In addition, students choose from a rich set of electives that includes data science, computer graphics, artificial intelligence, database systems, computer architecture, and computer networks, among other topics. A generous allotment of free electives allows students to combine study in computer science with study in auxiliary fields to formulate a program that combines experiences across disciplines.

Programme Learning Outcomes for BCA Programme:

The BCA Programme program enables students to attain, by the time of graduation:

- **PLO-A:** Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.
- **PLO-B:** Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation
- **PLO-C:** Ability to learn and acquire knowledge through online courses available at different MOOC Providers.
- **PLO-D:** Ability to link knowledge of Computer Science with other two chosen auxiliary disciplines of study.
- **PLO-E:** Display ethical code of conduct in usage of Internet and Cyber systems.
- **PLO-F:** Ability to pursue higher studies of specialization and to take up technical employment.
- **PLO-G:** Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.

BANKURA UNIVERSITY

- **PLO-H:** Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.
- **PLO-I:** Ability to present result using different presentation tools.
- **PLO-J:** Ability to appreciate emerging technologies and tools.
- **PLO-K:** Apply standard Software Engineering practices and strategies in real-time software project development
- **PLO-L:** Design and develop computer programs/computer -based systems in the areas related to algorithms, networking, web design, .NET Technology and data analytics.
- **PLO-M:** Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
- **PLO-N:** The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
- **PLO-O:** The ability to work independently on a substantial software project and as an effective team member.

BANKURA UNIVERSITY

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With effect from the Academic Year : 2023-2024

SEMESTER – I

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/101/MJC-1	Computer Fundamentals	4	20	80		100	3	1	0
					T:80	L:00				
2	BCA/102/MN-1	Elective-I	4	See in POOL OF MINOR STREAM (ELECTIVE)						
3	BCA/103/MD-1	Mathematics-I	3	20	80		100	3	1	0
					T:80	L:00				
4	BCA/104/SEC-1	PC Software	3	20	80		100	3	1	4
					T:50	L:30				
5	BCA/105/AEC-1	Compulsory English: Literature and Communication	2	10	40		50	2	1	0
					T:40	L:00				
6	BCA/106/VAC-1	Environmental Studies	4	10	40		50	2	1	0
					T:40	L:00				
Total in Semester-I			**20**	**100**	**400**		**500**			

SEMESTER – II

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/201/MJC-2	Programming and Problem Solving through C-Language	4	20	80		100	3	1	4
					T:50	L:30				
2	BCA/202/MN-2	Elective-II	4	See in POOL OF MINOR STREAM (ELECTIVE)						
3	BCA/203/MD-2	Mathematics-II	3	20	80		100	3	1	0
					T:80	L:00				
4	BCA/204/SEC-2	Front End Web Design and Development	3	20	80		100	3	1	4
					T:50	L:30				
5	BCA/205/AEC-2 (A/B/C)	Modern Indian Language-I **Choose any one from the following** • A. Santali / B. Sanskrit / C. Bengali	2	10	40		50	2	1	0
					T:40	L:00				
6	BCA/206/VAC-2 (A/B/C/D/E)	**Choose any one from the following** • A. Health and Wellness • B. Understanding India: Indian Philosophical Traditions and Value Systems • C. Basics of Indian Constitution • D. Arts and Crafts of Bengal • E. Historical Tourism in West Bengal	4	10	40 T:40	L:00	50	2	1	0
Total in Semester-II			**20**	**100**	**400**		**500**			
7	BCA/207/INT-1	Summer Internship (Additional for getting UG CERTIFICATE)	**4**	**20**	80		100	0	0	4
					T:00	L:80				

UG CERTIFICATE	Student who opt to exit after completion of the first year (Semester-I & II) and have secure 40 credits will be awarded a **UG CERTIFICATE** if, in addition, the Summer Internship (4 Credit) (Sl. No.-7) during summer vacation of the first year.

SEMESTER – III

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/301/MJC-3	Digital Logic	4	20	80 T:50	L:30	100	3	1	4
2	BCA/302/MJC-4	Object Oriented Programming using C++	4	20	80 T:50	L:30	100	3	1	4
3	BCA/303/MN-3	Elective-III	4	See in POOL OF MINOR STREAM (ELECTIVE)						
4	BCA/304/MD-3	Mathematics-III	3	20	80 T:80	L:00	100	3	1	0
5	BCA/305/SEC-3	Digital Marketing	3	20	80 T:80	L:00	100	3	1	0
6	BCA/306/AEC-3 (A/B/C)	Modern Indian Language-II **Choose any one from the following** A. Bengali / B. Sanskrit / C. Santali	2	10	40 T:40	L:00	50	2	1	0
Total in Semester-III			**20**	**110**	**440**		**550**			

SEMESTER – IV

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/401/MJC-5	Operating System	4	20	80 T:50	L:30	100	3	1	4
2	BCA/402/MJC-6	Software Engineering	4	20	80 T:80	L:00	100	3	1	0
3	BCA/403/MJC-7	Data Structure & Algorithm through C++	4	20	80 T:50	L:30	100	3	1	4
4	BCA/404/MJC-8	Computer Networks	4	20	80 T:50	L:30	100	3	1	4
5	BCA/405/MN-4	Elective-IV	4	See in POOL OF MINOR STREAM (ELECTIVE)						
6	BCA/406/AEC-4	Compulsory English : Literature Language and Communication	2	10	40 T:40	L:00	50	2	1	0
Total in Semester-IV			**22**	**110**	**440**		**550**			
7	BCA/407/INT-2	Summer Internship (Additional for getting UG DIPLOMA)	**4**	**20**	80 T:00	L:80	100	0	0	4
UG DIPLOMA		Student who opt to exit after completion of the second year (Semester-I, II, III & IV) and have secure 82 credits will be awarded a **UG DIPLOMA** if, in addition, the Summer Internship (Sl. No.-7) (4 Credit) during summer vacation of the second year.								

SEMESTER – V

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/501/MJC-9	Computer Graphics and Multimedia	4	20	80		100	3	1	4
					T:50	L:30				
2	BCA/502/MJC-10	Database Management Systems	4	20	80		100	3	1	0
					T:50	L:30				
3	BCA/503/MJC-11	Microprocessor and System Software	4	20	80		100	3	1	4
					T:50	L:30				
4	BCA/504/MJC-12	Object Oriented Database Management System	4	20	80		100	3	1	0
					T:80	L:00				
5	BCA/505/MN-5	Elective-V	4	See in POOL OF MINOR STREAM (ELECTIVE)						
6	BCA/506/INT-3	Major Project & Viva-Voce	2	20	80		100	3	1	4
					T:00	L:80				
Total in Semester-V			**22**	**120**	**480**		**600**			

SEMESTER – VI

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/601/MJC-13	Programming in JAVA	4	20	80		100	3	1	4
					T:50	L:30				
2	BCA/602/MJC-14	Internet Systems	4	20	80		100	3	1	4
					T:50	L:30				
3	BCA/603/MJC-15	.NET Technologies	4	20	80		100	3	1	4
					T:50	L:30				
4	BCA/604/MJC-16	Introduction to Internet of Things	4	20	80		100	3	1	0
					T:80	L:00				
5	BCA/605/MN-6	Elective-VI	4	See in POOL OF MINOR STREAM (ELECTIVE)						
Total in Semester-VI			**20**	**100**	**400**		**500**			

UG DEGREE (BCA)	Student who wish to undergo three year UG Programme will be awarded **UG DEGREE (BCA)** after successful completion of three year (Semester-I, II, III, IV, V & VI).

SEMESTER – VII

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/701/MJC-17	Theory of Computation	4	20	80		100	3	1	0
					T:80	L:00				
2	BCA/702/MJC-18	Python Programming	4	20	80		100	3	1	4
					T:50	L:30				
3	BCA/703/MJC-19	Digital Image Processing	4	20	80		100	3	1	0
					T:80	L:00				
4	BCA/704/MJC-20	Cloud Computing	4	20	80		100	3	1	0
					T:80	L:00				
5	BCA/705/MN-7	Elective-VII	4	See in POOL OF MINOR STREAM (ELECTIVE)						
Total in Semester-VII			**20**	**100**	**400**		**500**			

SEMESTER – VIII

Sl. No.	Course Code	Course Title	Credit	Marks				No. of Hours		
				IA	ESE		Total	L	T	P
1	BCA/801/MJC-21	Distributed Systems	4	20	80		100	3	1	0
					T:80	L:00				
2	BCA/802/MJC-22	Unix and Shell Programming	4	20	80		100	3	1	4
					T:50	L:30				
3	BCA/803/MJC-23	Database Programming with PL/SQL	4	20	80		100	3	1	4
					T:50	L:30				
4	BCA/804/MJC-24	Web Technologies	4	20	80		100	3	1	0
					T:80	L:00				
5	BCA/805/MN-8	Elective-VIII	4	See in POOL OF MINOR STREAM (ELECTIVE)						
Total in Semester-VIII			**20**	**100**	**400**		**500**			

UG DEGREE(Hons.) (BCA (Hons.))	Student who wish to undergo four year UG Honours Programme will be awarded **UG DEGREE (HONOURS.) (BCA (Hons.))** after successful completion of four year (Semester-I, II, III, IV, V, VI, VII & VII).
UG DEGREE (Hons. With Research) (BCA (Hons. with Research))	Students who secure 75% marks and above first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year in replace of BCA/802/MJC-22, BCA/803/MJC-23 and BCA/804/MJC-24 papers of Semester-VIII. The students who secure 164 credits, including 12 credits from a research project/dissertation, are awarded **UG DEGREE (HONOURS WITH RESEARCH) (BCA (Hons. with Research)**
RESEARCH STREAM	

Sl. No.	Course Code	Course Title	Credit	Marks			No. of Hours		
				IA	ESE	Total	L	T	P
2	BCA/802/RPD-1	Research Methodology and IPR	4	20	80 (T:80 | L:00)	100	3	1	0
3	BCA/803/RPD-2	Research Ethics	4	20	80 (T:80 | L:00)	100	3	1	0
4	BCA/804/RPD-3	Research Project/Dissertation and Viva-voce	4	20	80 (T:00 | L:80)	100	3	1	4

Note: ***Besides the normal Curriculum, one Mandatory Non-Credit Course (MNC) to be introduced for each year. For the MNC course, weekly one class (either online of offline mode) may be arranged and the evaluation scheme may be entirely left over the Faculty member handling the course. Students may also be permitted to register for these courses in SWAYAM and NPTEL. These courses do not carry any credits.***

POOL OF MINOR STREAM (ELECTIVE)

A. Artificial Intelligence (AI) and Machine Learning (ML)

Course Code	Course Title	Marks			No. of Hours		
		IA	ESE	Total	L	T	P
MN-1A	Introduction to Artificial Intelligence	20	80 (T:80 | L:00)	100	3	1	0
MN-2A	Introduction to Machine Learning	20	80 (T:80 | L:00)	100	3	1	0
MN-3A	Deep Learning	20	80 (T:80 | L:00)	100	3	1	0
MN-4A	Fuzzy Logic and its Applications	20	80 (T:80 | L:00)	100	3	1	0
MN-5A	Knowledge Engineering and Expert Systems	20	80 (T:80 | L:00)	100	3	1	0
MN-6A	LISP Programming	20	80 (T:50 | L:30)	100	3	1	4
MN-7A	Neural Network	20	80 (T:80 | L:00)	100	3	1	0
MN-8A	Introduction to Natural Language Processing (NPL)	20	80 (T:80 | L:00)	100	3	1	0

B. Data Science (DS)

Course Code	Course Title	Marks			No. of Hours		
		IA	ESE	Total	L	T	P
MN-1B	Introduction to Data Science	20	80 (T:80 | L:00)	100	3	1	0
MN-2B	Data Security and Privacy	20	80 (T:80 | L:00)	100	3	1	0
MN-3B	Data Warehousing and Data Mining	20	80 (T:80 | L:00)	100	3	1	0
MN-4B	Data Modeling	20	80 (T:80 | L:00)	100	3	1	0
MN-5B	Statistics for Data Science	20	80 (T:80 | L:00)	100	3	1	0
MN-6B	Business Intelligence	20	80 (T:80 | L:00)	100	3	1	0
MN-7B	R – Programming for Data Science	20	80 (T:50 | L:30)	100	3	1	4
MN-8B	Big Data Analytics and Visualization	20	80 (T:80 | L:00)	100	3	1	0

C. Cyber Securities

Course Code	Course Title	Marks			No. of Hours		
		IA	ESE	Total	L	T	P
MN-1C	Introduction to Cyber Securities	20	80 (T:80 | L:00)	100	3	1	0
MN-2C	Cyber Laws in India	20	80 (T:80 | L:00)	100	3	1	0
MN-3C	Indian IT Act	20	80 (T:80 | L:00)	100	3	1	0
MN-4C	Fundamental Security Design Principles	20	80 (T:80 | L:00)	100	3	1	0
MN-5C	Network Security	20	80 (T:80 | L:00)	100	3	1	0
MN-6C	Cryptography and Data Security	20	80 (T:80 | L:00)	100	3	1	0
MN-7C	Legal & Ethical Issues and Ethical Hacking	20	80 (T:80 | L:00)	100	3	1	0
MN-8C	Cyber Forensics	20	80 (T:80 | L:00)	100	3	1	0

D. Software Engineering

Course Code	Course Title	Marks			No. of Hours		
		IA	ESE	Total	L	T	P
MN-1D	Principles of Management	20	80 (T:80 | L:00)	100	3	1	0
MN-2D	System Analysis and Design	20	80 (T:80 | L:00)	100	3	1	0
MN-3D	IT Service Management	20	80 (T:80 | L:00)	100	3	1	0
MN-4D	Software Designing	20	80 (T:80 | L:00)	100	3	1	0
MN-5D	Advance Software Engineering	20	80 (T:80 | L:00)	100	3	1	0
MN-6D	Software Project Management	20	80 (T:80 | L:00)	100	3	1	0
MN-7D	Software Testing	20	80 (T:80 | L:00)	100	3	1	0
MN-8D	Software Quality Assurance	20	80 (T:80 | L:00)	100	3	1	0

Note:

BCA = Bachelor of Computer Application, AEC = Ability Enhancement Course, MN=Minor Stream, MD=Multidisciplinary Course, SEC = Skill Enhancement Course, MJC= Major Discipline Specific Course, VAC=Value Added Course, INT = Internship, RPD = Research Project/ Dissertation, IA = Internal Assessment, ESE= End- Semester Examination, L = Lecture, T = Tutorial, and P = Practical

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QUESTION PATTERN

Theory Paper:

Full Marks: 80

Group	No. of Question Present in Question Paper	No. of Question Attempt by the Student	Marks of Each Question	Total marks
A	10 (MCQ)	10	1	10
B	15	10	2	20
C	6	4	5	20
D	6	3	10	30
Total				80

Full Marks: 50

Group	No. of Question Present in Question Paper	No. of Question Attempt by the Student	Marks of Each Question	Total marks
A	10 (MCQ)	10	1	10
B	8	5	2	10
C	6	4	5	20
D	2	1	10	10
Total				50

Practical Paper:

Full Marks: 30

Group	No. of Question Present in Question Paper	No. of Question Attempt by the Student by Lottery	Marks of Each Question	Total marks
A	5	1	15	15
B	5	1	15	15
Total				30

Major Project & Viva-Voce:

Full Marks: 80

Particulars	Total marks
Project Report & Presentation	50
Viva-Voce	30
Total	80

Internal Assessment (IA):

Full Marks: 20 (Theory Paper)

Particulars	Marks
Class Attendance	5
Assignments	5
Seminars	5
Co-curricular Activities and Behavior	5
Total	20

Full Marks: 20 (Theory + Practical Paper)

Particulars	Marks
Class Attendance + Lab. Attendance	5
Assignments + Lab. Note Book	5
Seminars	5
Co-curricular activities and behavior	5
Total	20

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LIST OF THE COURSES		
Sl. No.	**Course Code**	**Course Title**
1. ABILITY ENHANCEMENT COURSE (AEC):		
1	AEC-1	Compulsory English: Literature and Communication
2	AEC-2A	Modern Indian Language-I – Santali
3	AEC-2B	Modern Indian Language-I – Sanskrit
4	AEC-2C	Modern Indian Language-I – Bengali
5	AEC-3A	Modern Indian Language-II – Santali
6	AEC-3B	Modern Indian Language-II – Sanskrit
7	AEC-3C	Modern Indian Language-II – Bengali
8	AEC-4	
2. MAJOR STREAM:		
9	MJC-1	Computer Fundamentals
10	MJC -2	Programming and Problem Solving using C-Language
11	MJC -3	Digital Logic
12	MJC -4	Object Oriented Programming using C++
13	MJC-5	Operating System
14	MJC -6	Software Engineering
15	MJC -7	Data Structure & Algorithm through C++
16	MJC -8	Computer Networks
17	MJC -9	Computer Graphics and Multimedia
18	MJC -10	Database Management Systems
19	MJC -11	Microprocessor and System Software
20	MJC -12	Object Oriented Database Management System
21	MJC -13	Programming in Java
22	MJC -14	Internet Systems
23	MJC -15	.NET Technologies
24	MJC-16	Introduction to Internet of Things (IOT)
25	MJC -17	Theory of Computation
26	MJC -18	Python Programming
27	MJC -19	Digital Image Processing
28	MJC -20	Cloud Computing
29	MJC -21	Distributed Systems
30	MJC -22	Unix and Shell Programming
31	MJC -22	Database Programming with PL/SQL
32	MJC -24	Web Technologies

3. MINOR STREAM:		
A. Artificial Intelligence (AI) and Machine Learning (ML)		
33	MN-1A	Introduction to Artificial Intelligence
34	MN-2A	Introduction to Machine Learning
35	MN-3A	Deep Learning
36	MN-4A	Fuzzy Logic and its Applications
37	MN-5A	Knowledge Engineering and Expert Systems
38	MN-6A	LISP Programming
39	MN-7A	Neural Network
40	MN-8A	Introduction to Natural Language Processing (NPL)
B. Data Science (DS)		
41	MN-1B	Introduction to Data Science
42	MN-2B	Data Security and Privacy
43	MN-3B	Data Warehousing and Data Mining
44	MN-4B	Data Modeling
45	MN-5B	Statistics for Data Science
46	MN-6B	Business Intelligence
47	MN-7B	R – Programming for Data Science
48	MN-8B	Big Data Analytics and Visualization
C. Cyber Securities		
49	MN-1C	Introduction to Cyber Securities
50	MN-2C	Cyber Laws in India
51	MN-3C	Indian IT Act
52	MN-4C	Fundamental Security Design Principles
53	MN-5C	Network Security
54	MN-6C	Cryptography and Data Security
55	MN-7C	Legal & Ethical Issues and Ethical Hacking
56	MN-8C	Cyber Forensics
D. Software Engineering		
57	MN-1D	Principles of Management
58	MN-2D	System Analysis and Design
59	MN-3D	IT Service Management
60	MN-4D	Software Designing
61	MN-5D	Advance Software Engineering
62	MN-6D	Software Project Management
63	MN-7D	Software Testing
64	MN-8D	Software Quality Assurance
4. MULTIDISCIPLINARY COURSE		
65	MD-1	Mathematics-I
66	MD-2	Mathematics-II
67	MD-3	Mathematics-III
5. SKILL ENHANCEMENT COURSE (SEC):		
68	SEC-1	PC Software
69	SEC-2	Front End Web Design and Development

70	SEC-3	Digital Marketing
6. VALUE ADDED COURSE (VAC):		
71	VAC-1	Environmental Studies
72	VAC-2A	Health and Wellness
73	VAC-2B	Understanding India: Indian Philosophical Traditions and Value Systems
74	VAC-2C	Basics of Indian Constitution
75	VAC-2D	Arts and Crafts of Bengal
76	VAC-2E	Historical Tourism in West Bengal
7. SUMMER INTERNSHIP/PROJECT & VIVA-VOCE		
77	INT-1	Summer Internship
78	INT-2	Summer Internship
79	INT-3	Major Project & Viva-Voce

BANKURA UNIVERSITY

Curriculum and Credit Framework for BCA Programme

(Basic, Honours and Honours with Research)

Semester - I
Course Code: BCA/101/MJC-1
Course Title: Computer Fundamentals (4 Credit)

Course Objectives:
The main objective of this course is to introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing. It focuses on such computer literacy that prepares students for life-long learning of computer concepts and skills. Students discover why computers are essential components in education, business and society in this course.

Learning Outcomes: After successfully completing this course, a student will be able to:

- Student will be able to identify the components of a personal computer system
- Student will be able to demonstrate mouse and keyboard functions
- Student will be able to demonstrate window and menu commands and how they are used
- Student will be able to demonstrate how to organize files and documents on a USB/hard drive
- Student will be able to compose, format and edit a word document

Theory: 60 Lectures

Unit-I: Introduction: Introduction to computers, Evolution of computer, characteristics and capabilities, Block Diagram of a Computer, Types of Computers: Analogue, Digital, Hybrid, General and Special Purpose Computers, Generation of Computers, Computer Systems: Micros, Minis & Main-frames, Limitations of Micro Computer.

Unit-II: Number systems: Decimal Number system, Binary number system, Octal & Hexadecimal number system, 1's&2's complement Codes: ASCH, EBCDI Codes, Gray code & BCD.

Unit-III: Logic Gates: AND, OR, NOT GATES and their Truth tables, NOR, NAND & XOR gates

Unit-IV: Input Devices: Categorizing Input Hardware, Keyboard, Direct Entry — Card Readers, Scanning Devices — O.M.R., Character Readers, Thumb Scanner, MICR, Smart Cards, Voice Input Devices, Pointing Devices — Mouse, Light Pen, Touch Screen.

Unit-V: Output Devices: Output Fundamentals, Hardcopy Output Devices, Impact Printers, Non-Impact Printers, Plotters, Computer output Microfilm/Microfiche (COM) systems, Softcopy Output Devices, Cathode Ray Tube, Flat Screen Technologies, Projectors, Speakers.

Unit-VI: Central Processing Unit: The Microprocessor, control unit, ALU, Registers, Buses, Main Memory, RAM,ROM.

Unit-VII: Storage Devices: Storage Fundamentals, Primary and Secondary Storage, Data Storage and Retrieval Methods — Sequential, Direct & Indexed Sequential, Tape Storage and Retrieval Methods Tape storage Devices, characteristics and limitations, Direct access Storage and Microcomputers – Hard Disks, Disk Cartridges, Direct AccessStorage Devices for large Computer systems, Mass storage systems and Optical Disks, CD ROM.

Unit-VIII: Computer Software & Languages: System Software: System software Vs. Application Software, Types of System Software, Introduction and Types of Operating Systems. Boot Loader, Diagnostic Programs, BIOS, Utility Programs.

Application Software: Microcomputer Software, Interacting with the System, Trends in PC software, Types of Application Software, Difference between Program and Packages.

Computer Languages: Definition, Generations of computer languages, Types of Languages, Language Processors: Assembler, Interpreter, Compiler, Linker and Loader.

Unit-IX: Problem Solving: Algorithms, Flow Charts, Decision Tables and Pseudo Code.

Text Books/Reference Books/Online Resources:

1. Computer Fundamentals - P. K. Sinha
2. Rajaraman V. -Fundamentals of computers, Prentics hall of India.
3. Digital circuit and designs -S. Salivahanan, S. Arivazhagan - Vikash Publications.

Semester - I
Course Code: BCA/102/MN-1A
Course Title: Introduction to Artificial Intelligence (4 Credit)

Course Objectives:
Introduction to AI is an introductory course in Artificial Intelligence. The goal is to acquire knowledge on intelligent systems and agents, formalization of knowledge, reasoning with and without uncertainty, machine learning and applications at a basic level.

Learning Outcomes:
After the completion of this course, the students will be able to:
Identify problems where artificial intelligence techniques are applicable. Apply selected basic AI techniques; judge applicability of more advanced techniques. Participate in the design of systems that act intelligently and learn from experience.

Theory: 60 Lectures

Unit-I: Introduction to Artificial Intelligence: Definition of AI, Future of Artificial Intelligence, Characteristics of Intelligent Agents, Typical Intelligent Agents.

Unit-II: AI Project Cycle: Definition, Flow chart (AI Project Cycle), Problem Scoping, Data Acquisition, Data Exploration, Modelling.

Unit-III: Problem Solving Methods: Problem solving Methods, Search Strategies, Uninformed and Informed Search, Local Search, Heuristics, Algorithms and Optimization Problems, Searching with Partial Observations, Constraint: Satisfaction Problems, Constraint Propagation, Backtracking Search, Game Playing, Optimal Decisions in Games, Alpha-Beta Pruning, Stochastic Games.

Unit-IV: Knowledge Representation: Knowledge Representation, First-Order Predicate Logic, Prolog Programming, Unification, Forward and Backward Chaining, Resolution, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

Unit-V: Software Agents: Architecture for Intelligent Agents, Agent communication, Negotiation and Bargaining, Argumentation among Agents, Trust and Reputation in Multi-agent systems.

Unit-VI: Artificial Intelligence Applications: Artificial Intelligence applications, Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robotics, Hardware and Software for Robots, Planning and Perception.

Text Books/Reference Books/Online Resources:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. N. J. Nilson, Principle of AI, Narosa
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991
4. Russell & Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.

Semester - I
Course Code: BCA/102/MN-1B
Course Title: Introduction to Data Science (4 Credit)

Course Objectives:
This course is intended to provide an introduction into the field of Data Science. Students will develop skills in appropriate technology and basic statistical methods by completing hands-on projects focused on real-world data and addresses the social consequences of data analysis and application.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Identify and describe the methods and techniques commonly used in data science.
- Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data.
- Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an integrated capacity.
- Create and modify customizable tools for data analysis and visualization per the evaluation of characteristics of the data and the nature of the analysis.
- Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources

Theory: 60 Lectures

Unit – I: Introduction: Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pre-Processing: Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III: Exploratory Data Analytics: Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV: Model Development: Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V: Model Evaluation: Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Text Books/Reference Books/Online Resources:

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global

Semester - I
Course Code: BCA/102/MN-1C
Course Title: Introduction to Cyber Securities (4 Credit)

Course Objectives:
The objective of the courses to

- Understand the fundamental s of cyber security and cybercrimes.
- Understand the tools and methods in cybercrimes and understanding computer forensics.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Understand the basic concepts of cyber security and cybercrimes.
- Understand the security policies and cyber laws.

Theory: 60 Lectures

Unit-I: Introduction to Cybercrime: Cybercrime- Definition and Origins of the Word Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit-II: Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit-III: Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS At-tacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft).

Unit-VI: Understanding Computer Forensics: Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer

Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics.

Unit-V: Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Ant forensics.

Unit-VI: Introduction to Security Policies and Cyber Laws: Need for an Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues, Overview of Intellectual Property Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.

Text Books/Reference Books/Online Resources:

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, Publish Date 2013.
2. Dr. Surya PrakashTripathi, RitendraGoyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Press. ISBN: 9789351194736, 2015.
3. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 - 1-118 -84965 -1.
4. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec 2010.
5. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, McGraw-Hill Publication.

Semester - I
Course Code: BCA/102/MN-1D
Course Title: Principles of Management (4 Credit)

Course Objectives:

To explain the evolution of Management and its principles, discuss the functions of management and their importance in business and propose the application of the principles of management in an organizational setup

Learning Outcomes:

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

- Learners will absorb various management concepts such as planning, organizing, implementing, staffing, coordinating, controlling, motivating and Managerial Grid
- Learners will recognize the human skills and conceptual skills as per industry requirements about basic management skills.
- Learners will diagnose various styles and qualities of efficient leadership, Coordination, Controlling, Green Management and Corporate Social Responsibility.

Theory: 60 Lectures

Unit-I: Introduction to Management: Definition, Features of Management, Management Functions, Management as a Process, Importance of Management, Management and Administration, Functional Areas of Management, Managerial Skills, Roles of a Manager, Levels of Management, Management as a Science as well as an Art.

Unit-II: Planning: Meaning and Definition, Features, Steps in Planning Process, Approaches, Principles, Importance, Advantages and Disadvantages of Planning, Types of Plans, Types of Planning, Management by Objectives.

Unit-III: Decision-Making: Meaning, Characteristics, Decision-Making Process, Guidelines for Making Effective Decision, Types of Decisions.

Unit-IV: Organization and Organization Structure: Organizing Process – Meaning and Definition, Characteristics, Process, Need and Importance, Principles, Span of Management. Organization Chart – Types, Contents, Uses, Limitations, Factors Affecting Organizational Chart, Organizational Structure – Line Organization, Line and Staff, Functional, Project, Matrix and Virtual.

Unit-V: Staffing: Meaning, Nature, Importance, Staffing Process – Manpower Planning, Recruitment, Selection, Orientation and Placement, Training, Remuneration, Performance Appraisal, Promotion and Transfer.

Unit-VI: Direction and Supervision: Direction – Definition, Nature, Need and Importance, Principles of Directing. Supervision – Role and Functions of a Supervisor, Effective Supervision, Direction and Supervision.

Unit-VII: Controlling: Meaning, Features, Importance, Control Process, Characteristics of an Effective Control System, Types of Control.

Unit-VIII: Co-ordination: Definition, Characteristics, Essentials, Types and Techniques, Principles, Obstacles and Needs.

Unit-IX: Motivation and Leadership: Motivation: Concept, Theories – Classical and Modern, Importance, Financial and Non-Financial Motivation, Positive and Negative Motivation, Group Motivation. Leadership: Definition, Meaning, Factors, Theories, Principles and Leadership Styles.

Unit-X: Communication: Definition, Meaning, Nature, Communication Process, Types and Barriers to Communication.

Text Books/Reference Books/Online Resources:

1. Management Today Principles& Practice- Gene Burton, Manab Thakur, Tata McGraw-Hill,Publishing Co. Ltd.
2. Management – James A. F. Stoner, Prentice Hall, Inc .U.S.A.
3. Management: Global Prospective –Heinz Weihrich& Harold Koontz, Tata McGrawHill, Publishing Co.Ltd.
4. Essential of Database Management Systems -AlexisLeon, MathewsLeon
5. Management –Task Resp, Practices – PetaDruche “willian Heinemann LTD.
6. Gilbert: Principles of Management, McGraw Hill.

Semester - I
Course Code: BCA/103/MDC-1
Course Title: Mathematics-I (4 Credit)

Course Objectives:

Be able to perform basic computations in higher mathematics. Be able to read and understand middle-level proofs. Be able to write and understand basic proofs. Develop and maintain problem-solving skills.

Learning Outcomes:

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

- Understand the foundations of mathematics
- Be able to perform basic computations in higher mathematics

- Be able to read and understand middle-level proofs
- Be able to write and understand basic proofs
- Develop and maintain problem-solving skills
- Use mathematical ideas to model real-world problems
- Be able to communicate mathematical ideas with others
- Have experience using technology to address mathematical ideas

Theory: 60 Lectures

Unit-I: Algebra: Sets, Union and Intersection, Complement, Mapping, Composition, notion of a Group, Ring, Field with simple examples.

Unit-II: Complex Number: Modulus and amplitude, De Moiver's theorem

Unit-III: Polynomials, Division algorithm, Fundamental theorem of classical algebra (Proof not required), Descartes rule of sign and their application, Relation between roots and coefficients; symmetric function of roots, Transformation of polynomial equation, Cardon's solution of cubic equation, Determinants, Addition andMultiplication of Matrices, Inverse of a Matrix ; Solution of linear equations in three variables by Cramer's rule and solution of three line linear equations by matrix inversion methods.

Unit-IV: Vector spaces, Subspaces, Bases and Dimensions, Co-ordinates, Linear Transformation, The Algebra of Linear Transformations.

Unit-V: Vector Algebra: Scalars & vectors, vector addition, linear combination of vectors, condition of colinearity of three points, scalar and vector products, scalar triple product and vector triple product.

Unit-VI: Analytical Geometry: Translation and rotation of rectangular axes, invariants, general equation of second degree-reduction to standard forms and classification. Plane polar equation of a straight line, circle, ellipse, parabola and hyperbola.

Text Books/Reference Books/Online Resources:

1. A Text book of Algebra- B.K. Lahiri & K. C. Roy
2. Linear Algebra- Das & Roy
3. Co-ordinate Geometry- S. L. Loney
4. Differential Calculus- Das and Mukherjee
5. Integral Calculus - Das and Mukherjee

Semester - I
Course Code: BCA/104/SEC-1
Course Title: PC Software (4 Credit)

Course Objectives:
The main objective of this course is to introduce the fundamentals of PC Software and reinforce computer vocabulary, particularly with respect to personal use of computer software, the Internet, networking and mobile computing. It focuses on such computer literacy that prepares students for life-long learning of computer concepts and skills. Students discover why computers are essential components in education, business and society in this course.

BANKURA UNIVERSITY

Curriculum and Credit Framework for BCA Programme

(Basic, Honours and Honours with Research)

Learning Outcomes: After successfully completing this course, a student will be able to:

- Student will be able to compose, format and edit a word document
- Student will be able to create worksheet, charts in excel
- Student will be able to create presentation in PowerPoint
- Student will be able to send email messages (with or without attachments)
- Student will be able to navigate and search through the internet

Unit-I: Overview of OS: Introduction to DOS, Internal and external commands, batch files (autoexec.bat, config.sys), Line editors, History of Windows (Windows 3.x to up-to-date version), Desktop, user interface action, icon ondesktop, closing windows, renaming icons, resizing windows (maximizing and minimizing). Control panel.

Unit-II: Overview of MS-Word: Introduction to word, Overview, creating, saving, opening, importing, exporting, and inserting files, formatting pages, paragraphs and sections, indents and outdents, creating lists and numbering. Headings, styles, fonts and font size, editing, positioning, viewing texts, searching and replacing text, inserting page breaks, page numbers, bookmarks, symbols, and dates. Using tabs and tablets, header, footer, and printing, mail merge and labels.

Unit-III: Overview of MS-Excel: Getting started with Excel, Worksheet overview, entering information, Editing cell, commands and functions, moving and copying, Inserting and deleting rows and columns, printing worksheet, Creating Charts, Naming range and using statistical, math, and financial function, database in a worksheet, Additionalformatting commands and drawing toolbars, Other commands and functions

Unit-VI: Overview of Power points: Slide creation with PowerPoint, presenting shows for corporate and commercial using power point.

Unit-V: Overview of Cloud Management with Security of Data: Introduction to MS-Teams and MS-SharePoint, Basic Document Management and Document Library, Excel Power Query, MS-Teams App Store, Creating webpages and web parts, Creating forms and Surveys, Restricted Access Management for data security, Integration of MS- SharePoint with MS-Teams.

Unit-VI: Introduction to Internet: Basic internet terms, getting connecting to internet, Internet applications, E-mails, Searching the web, Search engine, and computer viruses.

Text Books/Reference Books/Online Resources:

1. Introduction to Computers with MS-Office-Leon, TMH

Practical:

1. Create a bio data and manipulate text and format using MS-Word.
2. Create a document and design a department invitation using formatting option.
3. Create a document and to insert picture in right side and related information in left side using page layout option in MS-Word.
4. Create text manipulation and mathematics equation with scientific notations.
5. Create your college class timetable using table option in MS- Word.
6. Create a Student mark analysis table using table option in MS- Word.
7. Create a Student mark analysis table and apply formula to Total, Average using formula function in MS-Word. And then convert the Student Mark Table into text using convert option in MS- Word.

8. To write a Student mark statement letter and merge the draft with student's academic database using mail merge on a letter head in MS-Word.
9. To draw a flowchart to find sum of two numbers using drawing toolbars in MS-Word.
10. To create a flowchart for course chart using drawing toolbars in MS-Word.
11. Do the following task in MS Excel

    a. Create a Blank workbook
    b. Save the Workbook as ExcelLabOne.xlsx in Document > MSExcelLabs folder
    c. Type "Working with Excel Math" in cell A1
    d. Merge and Center the text in cell A1 to the range A1:E1
    e. Apply Title style to the range A1:E1
    f. Type Addition in cell A2
    g. Type Subtraction in cell A3
    h. Type Multiplication in cell A4
    i. Type Division in cell A5
    j. Auto-fit the contents in column A
    k. Insert a row above row #2
    l. Type "Basic Math" in cell A2
    m. Merge and Center the text in cell A2 to the range A2:E2
    n. Apply Heading 4 to the range A2:E2
    o. Apply the Calculation Style to the range A3:A6
    p. Type = 4 + 6 / 2 in cell B3 then type = (4 + 6) / 2 in cell D3
    q. Type = 6 – 6 * 2 in cell B4 then type = (6 – 6) * 2 in cell D4
    r. Type = 2 * 2 + 6 in cell B5 then type = (2 * 2) + 6 in cell D5
    s. Type = 9 / 3 + 4 in cell B6 then type = (9 / 3) + 4 in cell D6
    t. Press Ctrl + ~ then press Ctrl + ~ again
    u. Save and submit ExcelLabOne.xlsx to your instructor

12. Use of Formulas Sum, Average, If, Count, Counta, Countif & Sumif

Roll No	Student Name	Bengali	English	Math	Physics	Chemistry	Total	Average	Grade
1	RAM	20	10	14	18	15	77	15.4	A
2	ASHOK	21	12	14	12	18	?	?	?
3	MANOJ	33	15	7	14	17	?	?	?
4	RAJESH	15	14	8	16	20	?	?	?
5	RANJANA	14	17	10	13	18	?	?	?
6	POOJA	16	8	20	17	15	?	?	?
7	MAHESH	18	19	3	10	14	?	?	?
8	ASHUTOSH	19	20	7	14	18	?	?	?
9	ANIL	22	13	8	12	19	?	?	?
10	PREM	26	12	10	11	27	?	?	?

Q.a Find the Total Number & Average in all Subjects in Each Student.
Q.b Find Grade Using If Function - If Average Greater >15 then "A" Grade otherwise "B" Grade

Q.c How Many Student "A" and "B" Grade Use of Countif

Q.d Student Ashok and Manoj Total Number and Average Use of Sumif

Q.e Count how many Students Use of Counta

Q.f How Many Student Bengali & English Subject Number Grater Then > 20 and <15 Use of Countif

13. Use of Formulas - Product, If, Counta, Countif, Sumif

SRNO	ITEMS	QTY	RATE	AMOUNT	GRADE
1	AC	20	40000	800000	Expensive
2	FRIDGE	30	20000	?	
3	COOLER	15	10000	?	
4	WASHING MACHINE	14	15000	?	
5	TV	18	20000	?	
6	FAN	17	2000	?	
7	COMPUTER	10	25000	?	
8	KEYBOARD	5	250	?	
9	MOUSE	25	100	?	
10	PRINTER	30	12000	?	

Q. a Using of Product Fomula for Calculate Amount = Qty*Rate

Q. b How Many Items in a List

Q. c How Many Items qty Greate Then > 20 and Less Then <20

Q. d Calculate Item Computer Qty, Rate and Amount using Sumif Formula

Q. e If Items Amount is Greater > 500000, Then Items "Expensive" otherwise "Lets Buy it".

14. Sales Report (Use of Formulas - Sum, If, Counta, Countif, Sumif, Vlookup, Lookup)

SALESMAN	JAN	FEB	MAR	APR	MAY	JUNE	SALES	TARGET	RESULT
RAMESH	2000	1500	300	1400	1000	1400	7600	10000	NOT ACHIVED
RAKESH	5000	1200	500	1200	1200	2800	?	12000	?
RAHUL	3000	800	1200	3000	1500	3500	?	18000	?
POOJA	1000	900	1800	5000	1400	1200	?	10000	?
MANOJ	500	1000	2300	8000	1700	1400	?	12000	?
ASHOK	800	500	2400	1900	1800	1800	?	10000	?
AJEET	1200	1400	1500	700	2500	7000	?	12000	?
ALOK	1500	1800	1800	1800	300	1500	?	10000	?
AMRIT	1800	2500	1700	1500	2800	1800	?	12000	?
SURENDRA	200	3000	1900	1200	1500	3000	?	10000	?
SHASHI	1600	1200	2000	800	1700	800	?	10000	?

15. Create an excel worksheet of your own and insert data. Then create a Pie chart for the data.
16. Create an excel worksheet of your own and insert data. Then create a line chart for the data.
17. Create an excel worksheet of your own and insert data of students with their percentage of marks. Now implement conditional formatting to distinguish students percentage like the following.

(percentage>=60 Green. percentage>=45 Yellow, percentage<34 RED)

18. Create an excel worksheet of your own and insert student data in it. Now implement freeze pane to lock column heading, and student roll and name.
19. Do the following task in power point.
    a. Open a Blank presentation
    b. Save the presentation as PowerPointLabOne.pptx
    c. Add a Title to the first slide: the name of your college
    d. Type your first name and last name in the Subtitle section
    e. Add a New Slide which has a Title and Content
    f. Add a title to the second slide “My Future Goals”
    g. In the Content section of the second slide, add at least three Personal Goals
    h. Right click on the second slide from the left panel, then choose Duplicate Slide
    i. Highlight the text in the Content area of the third slide. Under the Home tab, click Convert to SmartArt, then choose Basic Cycle
    j. Change the SmartArt Colors to Colorful—Accent Colors
    k. Change the SmartArt Styles to 3D Polished
    l. From the left panel, drag the third slide between the first and second slide
    m. Change the layout of the third slide, the slide that does not have the SmartArt, to Comparison
    n. Leave the title “My Future Goals”
    o. In the head of the first column, type “Goals in College,” then center the heading
    p. In the head of the second column, type “Goals after College,” then center the heading
    q. Add at least three goals in each section
    r. Make sure that slide #3 is selected from the left panel, then add a New Slide
    s. Change the layout of the new slide to Blank
    t. Insert a Graduation Online Picture from the Office ClipArt—Choose any image of your choice
    u. Change the ClipArt size to 3” X 3” and position it in the middle of the slide
    v. Apply the Wisp Design Theme
    w. Save and upload PowerPointLabOne.pptx to your instructor
20. Create a five (5) slide presentation about your City.
21. Create a five (5) slide presentation for Environment awareness.
22. Create a five (5) slide presentation about tourist spots in Bankura.
23. Create a five (5) slide presentation about Prospects of BBA (H) course.
24. Create a five (5) slide presentation on prevention of Road accident.
25. Create a five (5) slide presentation on prevention of pollution in your area.
26. MS-Team
    a. Create a new Team.
    b. Add 2 owners.
    c. Add 3 Members.
    d. Restrict access of members to only view file with visitor category.
    e. Provide edit access to owners.
    f. Create 2 folders named Confidential and All documents.

g. Restrict access of confidential folder to only the owners, the members should not be able to view the contents of the folder name Confidential.
h. Owners should be able to view all folders.

27. Power Query
    a.
        i. Connect to Employee Data file – (Multiple Raw Files to be made available in Lab)
        ii. Replace missing gender & department values
        iii. Remove employees without salary
        iv. Extract employee's country and remove address column
        v. Extract year of join
        vi. Publish data to Excel
    b.
        i. Connect to web source, the database of Member of Parliament of India
        ii. Make a power query to automatically update the database, whenever any alteration in the list.
        iii. Make a graph show case the various metrics in the list, eg, who has the max MPs, who has the max qualifies MPs, who has the most rich MPs etc
    c.
        i. Connect to the Share market live database and make a connection auto refresh, every 30 seconds
        ii. The report should show top 10 stocks and bottom 10 stocks

28. Website using SharePoint and MS – Teams
    a. Create a Website of your college and include the weather of the 4 metro cities with auto update
    b. Provide only view access to 3 people
    c. Include point 2 from the power query as graphs in your website.
    d. Include point 3 from the power query as excel input to display the result.

Semester - II
Course Code: BCA/201/MJC-2
Course Title: Programming and Problem Solving through C-Language (4 Credit)

Course Objectives:
The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

Learning Outcomes:
- After the completion of this course, the students will be able to develop applications through C Programming Language.

Theory: 60 Lectures

Unit-I: Introduction to C: History of C, Overview of Procedural Programming and Object-Orientation Programming, Using main() function, Compiling and Executing Simple Programs in C.

Unit-II: Data Types, Variables, Constants, Operators and Basic I/O: Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic,

Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putcharetc), Formatted and Console I/O (printf(), scanf()), Using Basic Header Files (stdio.h, conio.hetc).

Unit-III: Expressions, Conditional Statements and Iterative Statements: Simple Expressions in C (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

Unit-IV: Functions and Arrays: Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments.

Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Two- dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

Unit-V: Derived Data Types (Structures and Unions): Understanding utility of structures and unions, declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members.

Unit-VI: Pointers in C: Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values.

Unit-VII: Memory Allocation in C: Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, storage of variables in static and dynamic memory allocation.

Unit-VIII: File I/O, Preprocessor Directives: Opening and closing a file, Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives.

Text Books/Reference Books/Online Resources:

1. C: The Complete Reference, Herbtz Schildt, Fourth Edition, McGraw Hill.2003
2. Programming in C - B. S. Gottfried (Sahaum Series)
3. Programming in ANSI C- E. Balaguruswami (TMH)
4. Let us C, Y Kanetkar, BPB

Practical:

1. Develop a program to solve simple computational problems using arithmetic expressions and the use of each operator leading to the simulation of a commercial calculator. (No built-in math function)?
2. Write a C program to find all odd numbers between 150 to 300.
3. Write a C program to find LCM of two (2) number.
4. Write a C program to find all 4-digit number which are divisible by 5, 7 and 3.

5. Develop a program to compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages?
6. Write a C program to print the following pattern.

```
*
* *
 * * *
* * * *
 * * * * *
```

7. Write programs to display each of the following patterns.

```
* * * * *
* * * *
* * *
* *
*
```

8. Write programs to display each of the following patterns.

```
* * * * * * *
* * *   * * *
* *       * *
*           *
```

9. Write programs to display each of the following patterns.

```
1
2 6
3 7  10
4 8  11  13
5 9  12  14  15
```

10. Design and develop an algorithm to find the reverse of an integer number NUM and check whether it is PALINDROME or NOT. Implement a C program for the developed algorithm that takes an integer number as input and output the reverse of the same with suitable messages. Ex: Num: 2014, Reverse: 4102, Not a Palindrome
11. Design and develop a C program to read a year as an input and find whether it is leap year or not. Also consider end of the centuries.
12. Draw the flowchart and Write a C Program to compute Sin(x) using Taylor series approximation given by Sin(x) = x - (x3/3!) + (x5/5!) - (x7/7!) + …….
13. Design develop and Write c program compute cosine (x) .(hint: 1 - (1/2!)x2 + (1/4!)x4 - (1/6!)x6) using Taylor series.
14. Write a program in C to find the factorial of a number without using recursive C function.
15. Write a c –code to determine whether the given number is prime or not using function.
16. Develop a program to find the reverse of a string and check for palindrome or not Display appropriate messages?
17. An Electricity board charges the following rates for the use of electricity: for the first 200 units 80 paise per unit: for the next 100 units 90 paise per unit: beyond 300 units Rs. 1 per unit. All users are changed a minimum of Rs. 100 as meter charge. If the total amount is more than Rs. 400, then an additional surcharge

of 15% of total amount is charged. Write a program to read the name of the user, number of units consumed and print out the charges.

18. Implement using functions to check whether the given number is prime and display appropriate messages (No built-in math function)
19. Develop a program to introduce 2D Array manipulation and implement Matrix multiplication and ensure the rules of multiplication are checked.
20. Write a C program to implement 2D array using pointer.
21. Develop a program to compute Sin(x) using Taylor series approximation. Compare your result with the built-in Library function. Print both the result with appropriate messages
22. Develop a program to sort the given set of N numbers using any sorting algorithm.
23. Develop a program to find the square root of a given number N and execute for all possible Inputs with appropriate messages. Note: Don't use library function sqrt(n).
24. Implement structures to read, write, and compute average marks and the students scoring above and below the average marks for a class of N students
25. Develop a program using pointers to compute the sum and standard deviation of all elements stored in an array of n real numbers.
26. Write a C program to sort an array of structure (roll, name, total marks) in ascending order of total marks.
27. Implement Recursive functions for binary to Decimal Conversion
28. Write a function to implement string operations such as compare, concatenate, string length. Convince the parameters passing techniques
29. Write a C program to insert five (5) records in a file and display it.
30. Write a C program to insert five (5) records in a file and display it, then find a match of a record provided by the user.

Semester - II
Course Code: BCA/202/MN-2A
Course Title: Introduction to Machine Learning (4 Credit)

Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Appreciate the importance of visualization in the data analytics solution
- Apply structured thinking to unstructured problems
- Understand a very broad collection of machine learning algorithms and problems
- Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
- Develop an appreciation for what is involved in learning from data.

Theory: 60 Lectures

Unit-I: Introduction: Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine Learning – Supervised Learning and Unsupervised Learning – Mathematical Foundations of Machine Learning – Applications of Machine Learning.

Unit-II: Supervised Learning – I: Simple Linear Regression – Multiple Linear Regression – Polynomial Regression – Ridge Regression – Lasso Regression – Evaluating Regression Models – Model Selection – Bagging – Ensemble Methods.

Unit-III: Supervised Learning – II: Classification – Logistic Regression – Decision Tree Regression and Classification – Random Forest Regression and Classification – Support Vector Machine Regression and Classification - Evaluating Classification Models.

Unit-IV: Unsupervised Learning: Clustering – K-Means Clustering – Density-Based Clustering – Dimensionality Reduction – Collaborative Filtering.

Unit-V: Association Rule Learning and Reinforcement Learning: Association Rule Learning – Apriori – Eclat – Reinforcement Learning – Upper Confidence Bound – Thompson Sampling – Q-Learning.

Unit-VI: Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

Text Books/Reference Books/Online Resources:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin
3. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
4. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
5. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
6. Sebastian Raschka, Vahid Mirjilili,”Python Machine Learning and deep learning”, 2nd edition, kindle book, 2018.
7. Carol Quadros,”Machine Learning with python, scikit-learn and Tensorflow”, Packet Publishing, 2018.
8. Gavin Hackeling,” Machine Learning with scikit-learn”, Packet publishing, O’Reily, 2018.
9. Stanford Lectures of Prof. Andrew Ng on Machine Learning

Semester - II
Course Code: BCA/202/MN-2B
Course Title: Data Security and Privacy (4 Credit)

Course Objectives:
The course will cover major developments in statistical data privacy and security, fundamentals of state-of-the-art privacy methods used in the digital world, as well as recent research trends in privacy and security. The course is intended to: (i) provide students with breadth in the areas of data privacy and security through lectures andhomework assignments; and (ii) enable students to specialize in a privacy-related or security-related topic.

Learning Outcomes:
After the completion of this course, the students will be able to:

- To know the concept of Data Security and privacy including personally private information, potential violations of privacy due to security mechanisms, and describe how privacy protection mechanisms run in conflict with security mechanisms.
- To know how an attacker can infer a secret by interacting with a database.
- To know how to set password refresh policy.
- Describe the consequences of data retention policies.

Theory: 60 Lectures

Unit-I: Fundamentals of Data Security & Privacy: Definition, difference between security and privacy, Databases and Exploratory Data Analysis, Data Representation and Storage, Authentication and Authorization, Database Security.

Unit-II: Threats: Definition, types of malware, how malware spread, malware protection, password protection, E-mail security.

Unit-III: Anonymization: Linkage and re-identification attacks, k-anonymity, l-diversity, t-closeness, Implementing anonymization, Anonymizing complex data, Privacy and anonymity in mobile environments.

Unit-IV: Differential Privacy (DP): Formalism and interpretation of DP, Fundamental DP mechanisms and properties, Interactive and non-interactive DP, DP for complex data, Local Differential Privacy (LDP).

Unit-V: Security and Privacy in AI and Machine Learning (AI/ML): Machine Learning (ML) background, Adversary modeling in AI/ML, Poisoning, evasion, and backdoor attacks, Test-time attacks: Model inversion, model stealing, **membership** inference, adversarial examples. Architectures and algorithms for privacy-preserving machine learning

Text Books/Reference Books/Online Resources:

1. Data Privacy and Security (Hb) by Salomon D., Springer
2. Data Protection and Privacy Implementation: India Perspective, Rk Dubey, Ajay Kr Verma

Semester - II
Course Code: BCA/202/MN-2C
Course Title: Cyber Law in India (4 Credit)

Course Objectives:
The objective of the courses to

- Concepts of Technology and Law.
- Providing elementary understanding the authorities under IT Act.
- Penalties & Offences under IT Act.
- Cyber Space Jurisdiction.
- Scope of Cyber Laws.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Technicalities of law in Cyber World.
- Extensive knowledge regarding jurisdictional issues in IT Act.
- Various important national and international cyber laws.
- Understands the scope of Cyber Law.

- The students are able to understand the basic concept of International Technology.

Theory: 60 Lectures

Unit-I: Introduction: History of Internet and World Wide Web, Need for cyber law, Cyber crime on the rise, Important terms related to cyber law.

Unit-II: Cyber law in India: Need for cyber law in India, History of cyber law in India, Information Technology Act, 2000, Overview of other laws amended by the IT Act, 2000, National Policy on Information Technology 2012.

Unit-III: Information Technology Act: Overview of the Information Technology Act, 2000

Unit-IV: Rules issued under the IT Act: Overview of Rules issued under the IT Act, 2000

Unit: V: Electronic commerce and Electronic contracts.

Unit: VI: Cyber crimes and Cyber Frauds: Definition of cyber crime, First Cyber crime, Types of cyber frauds, Cyber frauds in India, Preventive measures, Cyber crimes, Who commits cyber crimes?, Penalties and offences under the IT Act, 2000, Offences under other legislations, Investigation of cyber crimes in India.

Unit-VII: Regulatory Authorities: Department of Electronics and Information Technology, Controller of Certifying Authorities (CCA), Cyber Appellate Tribunal, Indian Computer Emergency Response Team (ICERT),

Unit-VIII: Case Laws: State of Tamil Nadu Vs Suhas Katti, Syed Asifuddin and Ors. V. The State of AP. & Anr., P.R. Transport Agency Vs. Union of India (UOI), SMC Pneumatics (India) Private Limited v. Jogesh Kwatra, Ritu Kohli case, Avnish Bajaj Vs. State (N.C.T.) of Delhi.

Text Books/Reference Books/Online Resources:

1. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi.
2. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi.
3. S.R.Myneni: Information Technology Law (Cyber Laws), Asia Law House, Hyderabad.
4. Chris Reed, Internet Law-Text and Materials, Cambridge University Press.
5. Pawan Duggal: Cyber Law- the Indian perspective Universal Law Publishing Co., New Delhi

Semester - II
Course Code: BCA/202/MN-2D
Course Title: System Analysis and Design (4 Credit)

Course Objectives:
This course examines the systems analysis and design process from understanding what a system should do through how a system should be implemented.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Define the system development life cycle.
    - Conducts research on existing systems.
    - Develop plans for the new system.

- Make the feasibility study about the system.
  - Explore the technical risks involved in the system's and technical possibilities.
  - Scheduling with using GANTT and PERT techniques.
  - Evaluates the economic self-sufficiency whether to install the system.
- Carry out the system analysis.
  - Identifies problems in the system.
  - Determine the cause of the problem in the system.
  - Find a solution of the problem in the system.

Theory: 60 Lectures

Unit-I: Basic Concept of Systems: Basic Concept of Systems The System: Definition and Concepts; Elements of a System: Input, Output Processor, Control, Feedback, Environment, Boundaries and Interface; Characteristics of a System; Types of systems -Physical and Abstract System, Open and Closed Systems, Man-made Systems; Information and its categories

Unit-II: Information System and System Analyst: Information Systems: TPS, OAS, MIS, DSS, ESS; System Analyst: Role and need of system analyst, System Analyst as an agent of change.

Unit-III: System Development Life Cycle: Introduction to SDLC, Various phases: study, analysis, design, development, testing, implementation, maintenance; System documentation: Types of documentation and their importance.

Unit-IV: System Planning and Information Gathering: Initial Investigations, Identification of user needs, Project Identification and Selection; Needs of Information Gathering, Determination of requirements, Information gathering tools: interviews, group communication, questionnaires, presentations and site visits.

Unit-V: Feasibility Study: Definition, Importance of feasibility study, Types of feasibility study, System selection plan and proposal, Prototyping, Cost-Benefit Analysis: Tools and Techniques.

Unit-VI: Tools for System Analysis: Data Flow Diagram (DFD), Logical and Physical DFDs, Developing DFD; System Flowcharts and Structured charts, Structured English, Decision trees and Decision tables.

Unit-VII: System Design: Module specifications, Module Coupling and cohesion, Top-down and bottom-up design; Logical and Physical design, Structured design.

Unit-VIII: Input and Output: Input Design: Input data, Input media and devices; Output design; Form Design: Classification of forms, Requirements of Form design.

Unit-IX: System Implementation and Maintenance: Need of System Testing, Types of System Testing, Quality Assurance; System Conversion, Conversion methods, procedures and controls, System evaluation and performance, Maintenance activities and issues.

Unit-X: System Security and Audit: System Security, Security Threats, Risk Analysis, Control measures, System Audit, Disaster Recovery Planning

Text Books/Reference Books/Online Resources:

1. V. Rajaraman, Analysis and Design of Information System, PHI

2. Elias m. Awad: System Analysis and Design
3. 2. Perry Edwards: System Analysis & design Mc Graw Hill

Semester - II
Course Code: BCA/203/MDC-2
Course Title: Mathematics-II (4 Credit)

Course Objectives:
Be able to perform basic computations in higher mathematics. Be able to read and understand middle-level proofs. Be able to write and understand basic proofs. Develop and maintain problem-solving skills.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Understand the foundations of mathematics
- Be able to perform basic computations in higher mathematics
- Be able to read and understand middle-level proofs
- Be able to write and understand basic proofs
- Develop and maintain problem-solving skills
- Use mathematical ideas to model real-world problems
- Be able to communicate mathematical ideas with others
- Have experience using technology to address mathematical ideas

Theory: 60 Lectures

Unit-I: Differential Calculus: Limit of a function and continuity. Fundamental properties of continuous functions (proofs not required); Derivative and Differential-Geometric meaning, Rules of Differentiation. Successive differentiation.

Unit-II: Rolle's theorem, Mean-Value theorems, Taylor's and Maclaurin's theorems with Cauchy's and Lagrange's forms of remainder; Taylor's series. Functions of several variables. Partial Derivatives. Total Differential. Euler's theorem on homogeneous functions of two variables. Application to plane curves.

Unit-III: Integral Calculus: Rules of Integration of Indefinite Integrals, Solution of Definite Integrals and their elementary properties. Idea of improper integrals.

Unit-IV: Differential Equations: order, degree, solution and formation of a differential equation. Standard techniques of solving a linear differential equation with constant coefficients. Cauchy's and Ligendre's Liner Differential Equations with variable coefficients.

Unit-V: Sequence and Series: Bounded and unbounded sequences, Convergence or divergence of a sequence, Behaviour of monotone sequences, Algebra of convergent sequences, Cauchy sequence, Cauchy's general principle of convergence, Infinite series, it's convergence and sum, series with positive terms and standard tests of convergence (without proofs), Alternating Series, Leibniz Test, Absolute convergence, Rearrangement of absolutely convergent series, Test of convergence of Abel and Dirichlet (without proofs)

Text Books/Reference Books/Online Resources:

1. Differential Equations - Sheplay I. (John Wiley & Sons, Inc)

2. Linear Algebra - Kenneth Hoffman & Ray Kunze (PHI)
3. Mathematical Analysis - S. C. Malic (Wiley Eastern Limited)
4. Differential Calculus – Das and Mukherjee
5. Integral Calculus – Das and Mukherjee

Semester - II
Course Code: BCA/204/SEC-2
Course Title: Front End Web Design and Development (4 Credit)

Course Objectives:
To introduce the basic concepts and techniques of client-side web programming and too enable the students to develop simple, interactive, and stylish websites using HTML, CSS and JavaScript.

Learning Outcomes:
After the completion of this course, the students will be able to:

- After studying this course, students will be able to build websites using the elements of HTML.
- After studying this course, students will be able to build interactive and stylish websites using client-side programming techniques with CSS and JavaScript.
- After studying this course, students will be able to learn to validate client-side data.
- After studying this course, students will be able to define the structure and contents of the website using different features of CSS.

Theory: 60 Lectures

Unit-I: Introduction: Introduction to internet and web design. Basic concepts of web architecture.

Unit-II: HTML: Introduction to hypertext mark-up language (html), creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames.

Unit-III: Cascading style sheet (CSS): Concept of CSS, creating style sheet, Importing style sheets, CSS properties, CSS styling (background, text format, controlling fonts), CSS rules, Style Types, CSS Selectors, CSS cascade, working with block elements and objects, working with lists and tables, CSS id and class, box model (introduction, border properties, padding properties, margin properties).

Unit-IV: Basics of JavaScript: Document object model, data types and variables, functions, methods and events, controlling program flow, built-in objects and operators, validations.

Text Books/Reference Books/Online Resources:

1. Nixon, R., Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5, O'Reilly, 2018.
2. Powell, T.A. HTML & CSS: The Complete Reference, 5th edition, Tata McGrawHill, 2017.
3. Duckett, J., JavaScript and JQuery: Interactive Front-End Web Development, Wiley, 2014.
4. Boehm, A., & Ruvalcaba, Z., Murach's HTML5 and CCS, 4th edition, Mike Murach & Associates, 2018.
5. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, Javascript, Perl CGI, BPB Publications, 2010

Practical:

1. Create an HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking text as well as marquee text.
2. Create an HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create an HTML document for displaying the current semester's timetable.
4. Create a website with horizontal and vertical frames. Top horizontal frame needs to show your college's name and logo. Bottom horizontal frame is to be split into two vertical frames. The left frame has hyperlinks to pages related to faculty, courses, student activities, etc. The right frame shows the corresponding webpage based on the link clicked on the left frame.
5. Create a student registration form using HTML which has the following controls and make an interactive content presentation using CSS:
   I. Text Box II. Dropdown box III. Option/radio buttons
   IV. Check boxes V. Reset and Submit button
6. Create a webpage for your department with a drop-down navigation menu for faculty, courses, activities, etc.. Implement the webpage using styles, rules, selectors etc. learned in CSS ● Write event-driven programs in JavaScript for the following:
   - Enter a number and on click of a button print its multiplication table.
   - Print the largest of three numbers entered by the user.
   - Find the factorial of a number entered by the user.
   - Enter a list of positive numbers using the prompt terminated by a zero. Find the sum and average of these numbers.
7. Create a student registration form using text, radio button, check box, drop down box, text field and all other required HTML elements. Customize the CSS and JavaScript to input and validate all data. Create functions to perform validation of each element, example:
   - Roll number is a 7-digit numeric value
   - Name should be an alphabetical value (String)
   - Non-empty and valid fields like DOB

Semester - II
Course Code: BCA/207/INT-1
Course Title: Summer Internship (4 Credit)

Course Objectives:
Acquire on job the skills, knowledge, and attitude, which are requisite to constitute a professional identity.

Demonstrate professional values and ethical standards.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Student is able to construct the company profile by compiling the brief history, management structure, products / services offered, key achievements and market performance for his / her organization of internship.
- For his / her organization of internship, the student is able to assess its Strengths, Weaknesses, Opportunities and Threats (SWOT).
- Student is able to determine the challenges and future potential for his / her internship organization in particular and the sector in general.

- Student is able to test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
- Student is able to apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
- Student is able to analyze the functioning of internship organization and recommend changes for improvement in processes.

Guidelines for Summer Training Report Writing

Viva Voce on Summer Training (BCA-S306T) is an important part of BCA course curriculum. It provides an opportunity to BCA students to write a summer training report on latest trends/technology related to software project. Following are guidelines for summer training report writing and assessment:

General Instructions

- Summer training report should not be less than 15 pages.
- Proper guidelines to be followed for preparation of summer training report.
- Proper dress code is mandatory for presenting and attending summer training PPT presentations.
- Attendance is compulsory for all students.
- If a student is absent for his presentation as per schedule, he/she must have assessed later on with reducedweightage in the presentation assessment.
- Always prepare a draft report first and print it out.
- Read it yourself first and correct any typographical or grammatical errors.
- **One copy** of final summer training report must be submitted as a **spiraled report** to the coordinator.

Main Components of a Report

- **Cover page**
  As per the given format.

- **Abstract**
  Abstract should be a narration of Problem Definition, Methodology used in third person's language not exceeding 200 words.

- **Acknowledgement and declaration**
  The Acknowledgement shall be brief and should not exceed one page. The students' signature shall be made at the bottom end above their name typed in capital.

- **Certificate**
  Attach a photocopy of a certificate issued from where training has been done.

- **Table of contents/Index page**
  The table of contents should list all material following it. The abstract, acknowledgement will be included in table of contents but the page numbers in lower case Roman letters are to be accounted for them. Pages starting with Introduction (Immediate after the Table of contents) should be consecutively numbered using Arabic Numerals.

- **Main Text with conclusions**

This includes various sections for Summer Training Report.

- **References**

Typing Instructions for Summer Training Report

- **Specification for Fonts**
  - **Font Face: Times new Roman**
  - **Font Size:** As per following preview
    - **Headings (Size 16 Bold)**
    - **Sub-Heading (Size 14 Bold and Italic)**
    - **Contents (Size 12 Normal)**
  - **Line spacing: 1.5**
  - **Text Alignment: Both left and right justified**
- Page Dimensions: Standard A4 size (297mm x 210mm)
- Margins:
  - **Top margin: 0.75”**
  - **Bottom margin: 0.75”**
  - **Left margin: 1”**
  - **Right margin: 0.75”**
- Footer: **Page number should be bottom centered.**
- Sections should be numbered as for example,**1. Introduction** etc.
- Subsections should be numbered as for example,***3.1 Simulation Tool*** etc
- Paragraphs and sentences should be short.
- Start of a paragraph should not be intended, rather, give one-line space between two paragraphs.
- A sub heading at the bottom of a page must have at least two full lines below it or else it should becarried over to the next page.
- The last word of any page should not be split using a hyphen.
- **References**

- References should be in IEEE format, i.e.,
  - Author name(s), title of paper/book, or if journal, its name, volume, issues, page number,publisher, year of publication
- Book titles must be in capitals
- Reference numbers should be marked liberally inside the text of the report-
  - eg., ……as given in [3]
- References should either be in chronological order or in the order in which they appear in thetext.

Semester - III
Course Code : BCA/301/MJC-3
Course Title : Digital Logic (4 Credit)
Course Objectives:

- To acquire the basic knowledge of digital logic levels and application of knowledge
- To understand digital electronics circuits.
- To impart how to design Digital Circuits.

Learning Outcomes:
At the end of the course, a student will be able to:

- Convert different type of codes and number systems which are used in digital communication and computer systems.
- Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
- Be able to design and analysis combinational logic circuits.
- Be able to design and analysis sequential logic circuits.

Theory: 60 Lectures

Unit I: Introduction to number system: Digital system, Binary numbers, Number base conversation, Positional number system, Binary, Octal, Hexadecimal and decimal number system, Representation of signed numbers and signed magnitude, Binary arithmetic: Binary Addition, Binary Subtraction, Binary multiplication, Binary division, Complementary number system: 1's and 2's complement, Binary subtraction using1's complement method, binary subtraction using 2's complement, Various binary codes: BCD, Excess-3, Gray code, BCD addition.

Unit II: Boolean algebra and Logic gates: Introduction to Boolean algebra -Addition and Multiplication in Boolean algebra: Binary logic function, Logic gates and Truth tables; AND logic, OR logic, NOT logic, NAND logic, NOR logic, EX-OR logic, EX-NOR logic, Boolean rules and Laws, De-Morgan's theorem.
Unit III: Gate level minimization: Realization of switching function using logic gates -Canonical forms, Standard forms, Sum of product forms, Product of sum forms, universal gates: NAND and NOR gates as universal gates, Realization of Boolean function using universal gates. The map method: Three variable map, Four variable map, Logic expression simplification with grouping cell, Quine-McClusky method, realization combinational circuit using truth tables.

Unit IV: Analysis and Design of combinational circuit: Introduction -Binary Adders: Half adder, Full adder; Binary Subtractor, Half Subtractor, Full Subtractor; Parallel binary adder, Binary comparator or Magnitude comparator, Decoders, Encoders, Multiplexer and De-multiplexer, Parity generator and Parity checkers, Code convertor.

Unit V: Latches and Flip-Flops: Latches: Active High S-R Latch (NOR gate S-R latch), Active Low S-R latch (NAND gate S-R latch), Gated S-R Flip-Flop, D-flip-flop, Edge triggered flip-flop: Edge Triggered S-R FF, Edge Triggered D-ff, Edge Triggered

J-K flip-flop, Race condition, Master slave J-K flip-flop.

Unit VI: Counters and Registers: Introduction to Three bit Asynchronous counter, Four bit asynchronous counter, ripple counter, Three Bit synchronous binary up counter, Three Bit synchronous binary down counter, Four Bit synchronous binary up counter, Four Bit synchronous binary down counter, Serial In and Serial Out register, Universal Shift register.

Unit VII: Memory and Programmable Logic: Introduction: Random Access memory, Read only memory, Programmable logic array, Sequential programmable devices.

Text Books/Reference Books/Online Resources:

1. Digital Design, M. Morris Mano, Pearson education.
2. Digital Circuit and Designs -S. Alivahanan, S. Arivazhagan - Vikash Publications.
3. Modern Digital Electronics: R. P Jain.

Practical

1. Identify various ICs and their specification-
    a. AND Gate
    b. OR Gate
    c. NOT Gate
    d. NAND Gate
    e. NOR Gate
    f. Exclusive –OR Gate
2. To realize why NAND gate is known as the universal gate by implementation of –
    a. NOT using NAND
    b. AND using NAND
    c. OR using NAND
    d. NOR using NAND
    e. XOR using NAND
    f. X-NOR using NAND
3. To realize why NOR gate is known as the universal gate by implementation of –
    a. NOT using NOR
    b. AND using NOR
    c. OR using NOR
    d. NAND using NOR
    e. XOR using NOR
    f. X-NOR using NOR
4. Implement Half-Adder using Basic Gates.
5. Implement Half-Adder using NAND Gates.
6. Implement Full-Adder using Basic Gates.
7. Implement Full-Adder using NAND Gates.
8. Implement Half-Subtractor using Basic Gates.
9. Implement Half-Subtractor using NOR Gates.
10. Implement Full-Subtractor using NOR Gates.
11. Implement of the following Boolean function using logic gates in both SOP and POS form-
    a. SOP: $AB+A^{/}B^{/}$
    b. POS: $(A+B)(B+C)(A+C^{/})$

12. Implement the Function: using Basic Gates.
13. Implement the Function: F = ABC+ DEF using IC 7411.
14. Implement a 4-bit Parallel Adder using IC 7483.
15. Conversion of Binary to Grey Code.
16. Conversion of Grey to Binary Code.
17. Implement a circuit that convert a Decimal digit from 8, 4, 2, 1 to 8, 4, -2, -1 code.
18. Implement a 3-bit Odd Parity genaratator using Basic Gates.
19. Implement a 4-bit Even Parity Checker using Basic Gates.
20. Implement a 2-bit Comparator using Basic Gates.
21. Implement a 4-bit Magnitude Comparator using 7485 ICs.
22. Implement a 3x8 decoder using Basic Gates.
23. Implement a 3x8 decoder using NAND Gates only.
24. Implement 2 × 1 Multiplexer using Basic Gates.
25. Implement 4 × 1 Multiplexer using NAND Gates.
26. Verification of State Table of S-R Flip-Flop using NAND and NOR gates.

Semester - III
Course Code : BCA/302/MJC-4
Course Title : Object Oriented Programming using C++ (4 Credit)
Course Objectives:
The course is designed to provide complete knowledge of OOP (C++) language. Students will be able to develop logics which will help them to create programs, applications in C++. Also by learning the basic programming constructs they can easily switch over to any other language in future.
Learning Outcomes:

- After the completion of this course, the students will be able to develop applications through C++ Programming Language.

Theory: 60 Lectures

Unit-I: Evolution of Programming methodologies: Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Selection control statements in C++.

Unit-II: Data types, Expression and control statements Iteration statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.

Unit-III: Functions: Introduction to functions, Passing Data to Functions, Scope and Visibility of variables in Functions, Structures in C++.

Unit-IV: Creating classes and Abstraction: Declaration of classes and objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions, Objects as function arguments, Arrays of objects, returning objects from function, structures and classes,

Unit-V: Constructors and Destructors: Constructors, Basic constructors, parameterized constructors, constructors with default argument, dynamic initialization of objects, copy constructors, dynamic constructors, destructors, constraints on constructors and destructors.

Unit-VI: Operator Overloading: Overloading unary operators, binary operators and arithmetic operators, multiple overloading, comparison operators, conversion between objects and basic types, conversion between objects of difference classes, constraints on type conversion.

Unit-VII: Derived Classes and Inheritance: Derived classes and base classes, defining a derived class, accessing base class member, Protected access specifier, derived class constructors, overriding the member function, class hierarchies, abstract base class, constructors and member function, public and private, access combinations and usage of access specifiers, classes and structures, Multiple Inheritance

Unit-VIII: Pointers: Pointers to objects, Virtual Functions, Polymorphism, Abstract classes.

Unit-IX: Files and streams in C++: Character and String input and output to files, Command Line Arguments and Printer Output.

Unit-X: Standard input and output operations: C++ iostream hierarchy, Standard Input/output Stream Library, Organization Elements of the iostream Library, Programming using Streams, Basic Stream Concepts.

Unit-XI: File input and output: Reading a File, Managing I/O Streams, Opening a File – Different Methods, Checking for Failure with File Commands, Checking the I/O Status Flags, Dealing with Binary Files, Useful Functions.

Unit-XII: Templates: Function templates and class templates

Unit-XIII: Standard Template library: Containers, iterators and application of container classes.

Unit-XIV: Exception handling: Throwing an exception, catching an exception: The try block, Exception handlers, Termination vs. Resumption, Exception specification, re-throwing an exception, uncaught exceptions, Standard exceptions, Programming with exceptions.

Text Books/Reference Books/Online Resources:

1. Object Oriented Programming through C++ E. Balagurusamy, TMH
2. C++: The Complete Reference, Herbtz Schildt, Fourth Edition, McGraw Hill.2003
3. C++ Primer, Stanley B. Lippman, Josee Lajoie, Barbara E. Moo, Published by Addison- Wesley, 5th Edition, 2012

Practical

1. Write a program in C++ to print the sum of two numbers.
2. Write a program in C++ to check the upper and lower limits of integer.
3. Write a program in C++ to swap two numbers.
4. Write a program in C++ to calculate the volume of a cube.
5. Write a program in C++ to convert temperature in Celsius to Fahrenheit.
6. Write a program in C++ to print a mystery series from 1 to 50.
7. Write a language program in C++ which accepts the user's first and last name and print them in reverse order with a space between them.
8. Write a C++ program to print the prime number in between 1to 50 and add the prime no.
9. Write a C++ program to swap two numbers using pointer
10. Write a C++ program to calculate sum of distance and display the result using friend function.
11. Write a program to count no of occurrence of particular character in a text file.
12. Write a C++ program to add two complex numbers overloading "+" operator.
13. Write a C++ program to display number of objects created using static member.
14. Define a class named 'Bank Account' to represent following members:

    Data members: -
    Account Number
    Name of Depositor
    Account Type
    Balance Amount
    Member functions:

- Initialize members
Deposit Amount
Withdraw Amount
Display Balance
Write a C++ program to test the Bank Account class for 10 customers.

15. Program to print positive number entered by the user If the user enters a negative number, it is skipped.
16. Program to show the concept of function overloading to calculate area where same name function differs in number of parameter.
17. Program to illustrate the use of constructor member function to initialize and object during its creation.
18. Program to understand use of copy constructor.
19. Program to understand the use of constructor overloading and destructor.
20. Program to illustrate how to derive a class from a base class.
21. Program to implement multilevel inheritance.
22. Program to implement hierarchical inheritance
23. Program to illustrate the concept of overriding member function.
24. Program to demonstrate the use of protected members.
25. Program to implement runtime polymorphism using virtual function.

Semester - III
Course Code: BCA/303/MN-3A
Course Title: Deep Leaning (4 Credit)
Course Objectives:

- To introduce the idea of artificial neural networks and their architecture
- To introduce techniques used for training artificial neural networks
- To enable design of an artificial neural network for classification
- To enable design and deployment of deep learning models for machine learning problems

Learning Outcomes:
After the completion of this course, the students will be able to:

- Understand the mathematics behind functioning of artificial neural networks
- Analyze the given dataset for designing a neural network based solution
- Carry out design and implementation of deep learning models for signal/image processing applications
- Design and deploy simple TensorFlow-based deep learning solutions to classification problems

Theory: 60 Lectures

Unit-I: Introduction: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

Unit-II: Feedforward Networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, auto encoders.

Unit-III: Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

Unit-IV: Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

Unit-V: Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

Unit-VI: Convolutional Neural Networks: LeNet, AlexNet.

Unit-VII: Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

Unit-VIII: Recent trends: Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning

Unit-IX: Applications: Vision, NLP, Speech (just an overview of different applications in 2-3 lectures).

Text Books / Reference Books / Online Resources:

1. Deep Learning with Keras byAntonio Gulli and Sujit Pal
2. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.
3. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016.
4. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", Apress, 2017.

Semester - III
Course Code: BCA/303/MN-3B
Course Title: Data Warehousing and Data Mining (4 Credit)
Course Objectives:

- Be familiar with mathematical foundations of data mining tools.
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Master data mining techniques in various applications like social, scientific and environmental context.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Learning Outcomes:
After the completion of this course, the students will be able to:

- Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
- Understand KDD process for finding interesting pattern from warehouse.
- Remove redundancy and incomplete data from the dataset using data preprocessing methods.
- Characterize the kinds of patterns that can be discovered by association rule mining.
- Discover interesting patterns from large amounts of data to analyze for predictions and classification.
- Develop a data mining application for data analysis using various tools

Theory: 60 Lectures

Unit-I: Data Warehousing: Introduction- Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, OLTP vs DWH-DWH requirements-trends in DWH-Application of DWH.

Unit-II: Data Warehousing Architecture: Reference architecture- Components of reference architecture - Data warehouse building blocks, implementation, physical design process and DWH deployment process. A Multidimensional Data, Model Data Warehouse Architecture.

Unit-III: Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Unit-IV: Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Unit-V: Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy – Clustering – Clustering Methods - Outlier analysis.

Unit-VI: Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining-Web mining.

Text Books / Reference Books / Online Resources:

1. Jiawei Han and Micheline Kamber, " Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2006.
2. Berson,"DataWarehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.
4. Arun K Pujari,"Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H,"Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. Mehmed Kantardzic," Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., DiwakarShyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006.

Semester - III
Course Code: BCA/303/MN-3C
Course Title: Indian IT Act (4 Credit)
Course Objectives:

- The course aims at acquainting the students with the Basic concepts of Technology and Law and also puts those concepts in their practical perspective. It also provides an elementary understanding of the authorities under IT Act as well as penalties and offences under IT Act.
- The course aims at providing extensive knowledge regarding IT Act, 2000 and Cyber Space Jurisdiction to the students so that students do not face any difficulty while handling practical cases in future as an advocate.
- The course aims at providing extensive knowledge regarding Issues of Internet Governance and International Organizations and their Roles to the students so that students do not face any difficulty while handling practical cases in future.

Learning Outcomes:
After the completion of this course, the students will be able to:

- In Depth Knowledge of Information Technology Act and Legal Frame Work Of Right To Privacy, Data Security And Data Protection.
- To develop the conceptual understanding of the cyber dispute and its resolution
- To trained the students to deal with cyber crimes cases
- To explain the jurisdictional issues in cyber space.

Theory: 60 Lectures

Unit-I: Salient features of IT Act – 2000: a) Definitions. b) Electronic record and digital signature authentication. c) Electronic governance. d) Various authorities under IT Act and their powers. e) Penalties. f) Offences. g) Miscellaneous.

Unit-II: Impact on other related Acts (Amendments): a) Amendments to Indian Penal Code. b) Amendments to Evidence Act. c) Amendments to Bankers Book Evidence Act. d) Amendments to Reserve Bank of India Act.

Unit-III: Concept of Cyber – space jurisdiction and other principal of jurisdiction: a) Territorial jurisdiction b) Extra Territorial jurisdiction c) Cyber – space jurisdiction.

Unit-IV: Investigation of Cybercrime (Technical Issue).

Unit-V: Amendments: Indian IT Acts amendments.

Unit-VI: Case Laws: Indian IT Acts Case Laws.

Text Books / Reference Books / Online Resources:

1. Raj, Niharikia, Law & Technology, Universal Law Publishing. Information Technology Act, 2000.

BANKURA UNIVERSITY

Curriculum and Credit Framework for BCA Programme

(Basic, Honours and Honours with Research)

Semester - III
Course Code: BCA/303/MN-3D
Course Title: IT Service Management (4 Credit)
Course Objectives:
Objectives Upon completion of this course, students will be able to: Understand how to plan and create a service value stream to make, deliver and support services. Know how relevant ITIL® practices contribute to creating, delivering, and supporting through SVS and value streams.
Learning Outcomes:
After the completion of this course, the students will be able to:

- Have knowledge and critical understanding of the fundamental principles of ITSM.
- Understand how ITSM can operate in an organisation to improve processes.
- Understand best management practice from a technical and non-technical perspective.

Theory: 60 Lectures

Unit-I: IT Service Management: Introduction, What is service management? What are services? Business Process, Principles of Service management: Specialization and Coordination, The agency principle, Encapsulation, Principles of systems, The service Life Cycle, Functions and processes across the life cycle. **Service Strategy Principles -** Value creation, Service Assets, Service Provider Service Structures, Service Strategy Principles. **Service Strategy -** Define the market, Develop the offerings, Develop Strategic Assets, Prepare for execution. **Challenges, Critical Success factors and risks -** Complexity, Coordination and Control, Preserving value, Effectiveness in measurement, Risks.

Unit-II: Service Design: Fundamentals. **Service Design Principles** - Goals, Balanced Design, Identifying Service requirements, identifying and documenting business requirements and drivers, Design activities, Design aspects, Subsequent design activities, Design constraints, Service oriented architecture, Business Service Management, Service Design Models. **Service Design Processes -** Service Catalogue Management, Service Level Management, Capacity Management, Availability Management, IT Service Continuity Management, Information Security Management, Supplier Management. **Challenges, Critical Success factors and risks -** Challenges, Risks.

Unit-III: Service Transition: Fundamentals. **Service Transition Principles -** Principles Supporting Service Transition, Policies for Service Transition. **Service Transition Processes** - Transition planning and support, Change Management, Service Asses Configuration Management, Service and Deployment Management, Service Validation and Testing, Evaluation, Knowledge Management. **Challenges, Critical Success factors and risks -** Challenges, Critical Success factors, Risks, Service Transition under difficult Conditions.

Unit-IV: Service Operation: Fundamentals. **Service Operation Principles** - Functions, groups, teams, departments and divisions, Achieving balance in service operations, Providing service, Operation staff involvement in service design and service transition, Operational Health, Communication, Documentation. **Service Operation Processes** -Event Management, Incident Management, Request fulfilment, Problem Management, Access Management, Operational activities of processes covered in other lifecycle **phases**. **Challenges, Critical Success factors and risks** - Challenges, Critical Success factors, Risks

Unit-V: Continual Service Improvement(CSI) Principles: CSI Approach, CSI and organizational change, Ownership, CSI register, External and Internal drivers, Service level management, Knowledge management, The Deming cycle, Service Measurement, IT governance, Frameworks, models, standards and quality Systems, CSI inputs and outputs. **CSI Process -** The seven step improvement process. **CSI Methods and Techniques** - Methods and techniques, Assessments, benchmarking, Service Measurement, Metrics, Return on Investment, Service reporting, CSI and other service management processes. **Organising for CSI -** Organisational development, Functions, roles, Customer Engagement, Responsibility model - RACI, Competence and training. **Technology considerations** - Tools to support CSI activities **Implementing CSI** - Critical Considerations for implementing CSI, The start, Governance, CSI and organisational change, Communication Strategy and Plan

Text Books / Reference Books / Online Resources:

1. Service Management, Fourth Edition, J.A. Fitzsimmons and M.J. Fitzsimmons, McGraw Hill.
2. Principles of Service Marketing and Management, Christopher Lovelock and Lauren Wright, Prentice Hall.
3. IT Service Management – A Concise Study, S. A. Kelkar, PHI

Semester - III
Course Code: BCA/304/MD-3
Course Title: Mathematics-III (4 Credit)
Course Objectives:

Be able to perform basic computations in higher mathematics. Be able to read and understand middle-level proofs. Be able to write and understand basic proofs. Develop and maintain problem-solving skills.

Learning Outcomes:

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

- Describe a data set including both categorical and quantitative variables to support or refute a statement,
- Apply laws of probability to concrete problems,
- Perform statistical inference in several circumstances and interpret the results in an applied context,
- Use mathematical tools, including calculus and linear algebra, to study probability and mathematical statistics and in the description and development of statistical procedures.
- Perform different accounting problems in Tally.

Theory: 60 Lectures

Unit-I: Probability and Statistics: Permutation and Combinations, Probability, Classical definition of probability. Conditional probability. Statistical independence of events. Random variable and its expectation and variance, joint dispersion of attributes.

Unit-II: Collection and presentation of data, Frequency distribution, Measures of central tendency, Measures of dispersion, Binomial, Poisson and Normal distribution.

Unit-III: Bivariate Frequency Distributions (scatter Diagram, Correlation coefficient and its properties, regression lines, correlation index and correlation ratio, rank correlation).

Unit-IV: Multiple linear regression, multiple correlation, partial correlation (for 3 variables only).

Unit-V: Random sampling, expectations and standard error of sampling mean. Expectation and standard error of sampling proportions.

Unit-VI: Test of significance based on t, F, and CHI square distribution.

Unit-VII: Numerical Methods and Algorithms Solution of non-linear equations: Bisection, Newton-Raphson, Regular-Falsi and Secant method. Interpolation and approximation- Lagrange Interpolation, Newton's Forward Interpolation and Newton's backward Interpolation methods.

Unit-VIII: Integration: Trapizoidal and Simpson's 1/3 rules.

Unit-IX: Solution of linear equations: Gaussian elimination, Gauss Sheidal method.

Unit-X: Solution of different equations; Eular's, Taylor's series, Runge-kutta (order-2)

Text Books / Reference Books / Online Resources:

1. C Language and Numerical Methods C Xaviers, New Age International
2. Fundamentals of Statistics – Goon, Gupta, DasGupta
3. Statistical Methods (vol 1 and 2) – N.G. Das.

4. Mathematical and Statistics – Ajay Goel and Alka Goel; Taxmann.
5. Statistics – Sancheti and Kapoor; Sultan Chand & Sons.

Semester - III
Course Code: BCA/305/SEC-3
Course Title: Digital Marketing (4 Credit)
Course Objectives:
To understand the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.
Learning Outcomes:
After the completion of this course, the students will be able to:

- Develop and execute a marketing plan, incorporating all elements of the marketing mix, segmentation and positioning strategies and other elements.
- Understanding of the role of both digital and traditional media in marketing, and the intersection of online and offline strategies and tactics.
- Guide the development of a digital presence from a marketing point of view.
- Proficient in marketing analytics and quantitative evaluation of the marketing environment.
- Working knowledge of website design and development.

Theory: 60 Lectures

Unit-I: Introduction to Digital Marketing: Meaning of Digital Marketing, Differences from Traditional Marketing, Return of Investments on Digital Marketing vs. Traditional Marketing, E Commerce, Tools used for successful marketing, SWOT Analysis of Business for Digital Marketing, Meaning of Blogs, Websites, Portal and Their Differences, Visibility, Visitor Engagement, Conversion Process, Retention, Performance Evaluation.

Unit-II: Search Engine Optimization (SEO): On page Optimization Techniques, Off Page Optimization Techniques, Preparing Reports, Creating Search Campaigns, Creating Display Campaigns.

Unit-III: Social Media Optimization (SMO): Introduction to Social Media Marketing, Advanced Facebook Marketing.

Unit-IV: Social Media Marketing: Word press Blog Creation, Twitter Marketing, LinkedIn Marketing, Instagram Marketing, social media Analytical Tools. Search Engine Marketing: Meaning and Use of Search Engine Marketing, Tools used — Pay Per Click, Google Adwords, Display Advertising Techniques, Report Generation.

Unit-V: Website Traffic Analysis, Affiliate Marketing and Ad Designing: Google Analytics, Online Reputation Management, Email Marketing, Affiliate Marketing, Understanding Ad Words Algorithm, Advertisement Designing.

Text Books / Reference Books / Online Resources:

1. Digital Marketing –Kamat and Kamat-Himalaya
2. Marketing Strategies for Engaging the Digital Generation, D. Ryan,
3. Digital Marketing, V. Ahuja, Oxford University Press
4. Digital Marketing, S.Gupta, McGraw-Hill
5. Quick win Digital Marketing, H. Annmarie, A. Joanna, Paperback edition

Semester - IV
Course Code : BCA/401/MJC-5
Course Title : Operating System (4 Credit)
Course Objectives:
To understand the structure and organization of the file system. To understand what a process is and how processes are synchronized and scheduled. To understand different approaches to memory management. Students should be able to use system calls for managing processes, memory and the file system.
Learning Outcomes:

After the completion of this course, the students will be able to learn

- How Operating System is Important for Computer System.
- To make aware of different types of Operating System and their services.
- To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- To know virtual memory concepts.
- To learn secondary memory management
- Write different shell and awk scripts

Theory: 60 Lectures

Unit-I: Introduction: Definition and functions of Operating System, Evolution of Operating Systems-Simple Batch Operating Systems, Multi-programmed Batched Operating Systems, Time- Sharing operating Systems, Personal Computer Operating Systems, Multi-processor Operating Systems, Distributed Systems, Real-Time Systems; Operating system structures-Layered approach, The kernel based approach, The virtual machine approach.

Unit-II: Operating System Architecture: Operating System as an Extended Machine, Layered Approach, Micro-Kernels, UNIX Kernel Components, Modules, Introduction to Virtual Machines, Virtual Environment & Machine Aggregation, Implementation Techniques.

Unit-III: Process Management: Process, Process State, Process Control Block, Process Scheduling, Operation on processes, Co-operating Processes, Threads.

Unit-IV: CPU Scheduling Algorithms: Basic Concepts of Scheduling: CPU-I/O Burst Cycle. CPU Scheduler, Pre-emptive / non pre-emptive scheduling, Dispatcher, Scheduling Criteria; Scheduling Algorithms, First come First Served Scheduling, Shortest-Job-First Scheduling, Priority Scheduling. Round-Robin Scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling, Multiple-Processor Scheduling, Real-Time Scheduling; Evaluation of CPU Scheduling Algorithms-Deterministic Modelling, Queuing Models, Simulations, Implementation.

Unit-V: Process Synchronization: Inter process Communication; Basic Structure, Naming: Direct Communication; Indirect Communication, Buffering; The Critical-section problem: Two Process Solution; Multiple Process Solutions; Semaphores; Monitors; Hardware Assistance.

Unit-VI: Deadlocks: System Model, Deadlock Characterization, Deadlock Handling; Deadlock Prevention, Deadlock Avoidance-Safe State, Resource-Allocation Graph Algorithm, Banker's Algorithm; Deadlock Detection-Single Instance of a Resource, Multiple Instances of a Resource and Recovery from Deadlock.

Unit-VII: Memory Management: Logical versus Physical Address Space Swapping; Contiguous Allocation-Single partition Allocation, Multiple Partition Allocation, Fragmentation; Paging-Concept of paging, Page Table Implementation; Segmentation-Concept of Segmentation, Segmentation Hardware, External Fragmentation.

Unit-VIII: Virtual Memory: Need for Virtual Memory Technique; Demand Paging; Page Replacement; Page Replacement Algorithms-FIFO Page Replacement Algorithm, Optimal Algorithm; LRU page Replacement Algorithm; Thrashing-Causes for Thrashing, Working Set Model, Page Fault Frequency.

Unit-IX: File System Interface and Implementation: Concept of a File- Attributes of a File, Operations on Files, Types of Files; Structure of File; File Access Methods-Sequential Access, Direct Access, Indexed Sequential Access; Directory Structure: Single Level Directory, Two Level Directory; Tree Structured Directories; Allocation Methods-Contiguous allocation, Linked allocation, Indexed allocation, Performance comparison; Free Space Management, Directory Implementation.

Unit-X: Input-Output Architecture: I/O Structure, I/O Control Strategies-Program controlled I/O, Interrupt-controlled I/O, Direct memory access; The I/O Address Space.

Unit-XI: Operating Systems in Distributed Processing: Centralized and Distributed Processing, Network Operating System (NOS) Architecture, Functions of NOS, Global Operating System (GOS), Remote Procedure Call (RPC), Distributed File Management.

Unit-XII: Security and Protection: Attacks on Security, Computer Worms, Computer Virus, Security Design Principles, Authentication, Protection Mechanism, Encryption, Security in Distributed Environment.

Unit-XIII: Unix Editors and commands: ed editor, vi editor, Redirections, piping, tees, filters, UNIX utilities: grep, sed, awk, tr etc.

Unit-XIV: Introduction to Shell scripts: Bourne shell, C shell, Shell variables, Scripts, meta-characters and environments, if and case statements, for, while and until loops.

Unit-XV: Awk programming: Awk arithmetic and variables, Awk built-in variable names and operators, arrays, strings.

Text Books / Reference Books / Online Resources:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8 th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles, 5 th Edition, Prentice Hall of India. 2008.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill 1992.
6. Y. Kanetkar, Unix Shell Programming, BPB.
7. Sumitabha Das, UNIX, concepts and applications, Mcgraw Hill

Practical

1. Write a shell Script to calculate sum of digits of a given number.
2. Write a shell Script to compute LCM of three given number.
3. Write a shell Script to find the first 8 Fibonacci numbers.
4. Write a shell Script to check whether a number is prime or not.
5. Write a shell Script to find out reverse of a four-digit given integer.
6. Write a shell Script to compute the series 1+3+5+7+…. up to 10th term.
7. Write a shell Script to convert Celsius to Fahrenheit & vice-versa.
8. Write a shell Script to compute factorial of an integer.
9. Write a shell Script to compute HCF of two given number.
10. Write a shell Script to find a given no is palindrome or not.
11. Write a shell Script to find the system date is leap year or not.
12. Write a shell Script to find a file (inputted by the user) is present in current directory or not give proper message.
8. Write a shell Script to find who are currently logged in in the system (display only the name).
9. Write a shell Script to merge contents of two files into a file, now find a particular string in the file.
10. Find the difference between echo $PATH; echo "$PATH"; echo '$PATH'; echo *; echo "*"; echo '*';

Semester - IV
Course Code : BCA/402/MJC-6
Course Title : Software Engineering (4 Credit)
Course Objectives:

- To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases.
- To provide an idea of using various process models in the software industry according to given circumstances.

Learning Outcomes:

At the end of the course students will be able to:

- Basic knowledge and understanding of the analysis and design of complex systems.
- Ability to apply software engineering principles and techniques.

Theory: 60 Lectures

Unit-I: Software Engineering Fundamentals: Definition of software product, Software Engineering Paradigms; Software engineering, Knowledge engineering, and End user development approaches.

Unit-II: System Analysis: An abstraction, Partitioning and projection, Systems specification, Software Requirements Specification (SRS) standards, Formal Specification methods, Specification tools, Flow based, Data based and Object – Oriented Analysis.

Unit-III: System Documentation: Principles of system documentation, types of documentation and their importance.

Unit-IV: System Planning: Data and fact gathering techniques-Interviewing, communications, presentations and site visit. Feasibility study, feasibility reports, prototyping, cost-benefit analysis-tools and techniques.

Unit-V: Systems Design: Idealized and constrained design, Process oriented design (Game and Sarson and Yourdon notations), Data oriented design (Warnier–Orr, E-R modelling), Object oriented design (Booch approach), Cohesion and Coupling, Design matrices, Design documentation standard.

Unit-VI: Role of CASE Tools: Relevance of CASE Tools, High-end and Low-end CASE Tools.

Unit-VII: Coding and Programming: Choice of programming languages, Mixed language programming and cell semantics, Reengineering legacy systems, Coding standard.

Unit-VIII: Software Quality and testing: Software quality assurance .Types of Software Testing (White Box and Black Box Testing, Unit Testing, Integration Testing, Verification and Validation of Software) , Debugging and Software Reliability analysis , Software quality and matrices, Software maturity model and extensions.

Unit-IX: Software Cost and Time estimation: Functions points, Issues in software cost estimation, Introduction to the Rayleigh curve, Algorithmic cost models (COCOMO, Putnam- Slim, Watson, and Felix), Other approaches to software cost and Size estimation (software complexity, Delphi , costing by analogy).

Unit-X: Software Project Management: Planning software , projects, Work breakdown structures, Integrating software design and project planning ,Software project teams, Projecting monitoring and control.

Text Books / Reference Books / Online Resources:

1. R S Pressman, Software Engineering; A Practitioner's Approach (7th Edition), MGH, 2009
2. P Jalote, An Integrated Approach to Software Engineering (2nd Edition), NPH, 2003
3. R. Mall, Fundamentals of Software Engineering (2nd Edition), PHI, 2004

Semester - IV

Course Code : BCA/403/MJC-7

Course Title : Data Structure & Algorithm through C++ (4 Credit)

Course Objectives:

Able to identify the appropriate data structures and algorithms for solving real world problems. Able to implement various kinds of searching and sorting techniques. Able to implement data structures such as stacks, queues, Search trees, and hash tables to solve various computing problems.

Learning Outcomes:

At the end of the course, the students will be able to:

- Implement basic data structures such as arrays and linked list.
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.

- Implement various searching and sorting algorithms.
- Programs to demonstrate the implementation of various operations on stack and queue.

Theory: 60 Lectures

Unit-I: Analysis of Algorithm: Introduction to Algorithm Design and Data Structures: Design and analysis of algorithm: Algorithm definition, comparison of algorithms. Top down and bottom up approaches to Algorithm design. Analysis of Algorithm (Mathematical Presentation- Frequency count, Complexity measures in terms of time and space). Structured approach to programming.

Unit-II: Elementary Data Structures-I (Arrays): Representation of arrays: single and multidimensional arrays. Address calculation using column and row major ordering. Various operations on Arrays, Vectors. Application of arrays: Matrix multiplication, Sparse polynomial representation and addition, Stacks and Queues: Representation of stacks and queues using arrays, Circular queues, Priority Queue and D-Queue, Applications of stacks and Queues, Conversion from infix to postfix and prefix expressions, Evaluation of postfix - 95 - expression using stacks. Pointers: Definition, Pointer Arithmetic, Array of pointers, Arrays in terms of pointers.

Unit-III: Elementary Data Structures-II (Linked Lists): Linked list: Singly linked list; operations on list, Linked Stacks and Queues: Representation of stacks and queues using Link List. Polynomial representation and manipulation using linked lists. Circular linked lists, doubly linked lists. Generalized list structure. Sparse Matrix representation using generalized list structure.

Unit-IV: Abstract Data types Stacks and Queues: Definition of ADT, Stack ADT (array implementation), FIFO queue ADT (array implementation)

Unit-V: Trees: Binary tree traversal methods: Preorder, In-order, Post-ordered traversal. Recursive Algorithms for above mentioned Traversal methods. Representation of trees and its applications: Binary tree representation of a general tree. Conversion of forest into tree. Threaded binary trees. Binary search tree. : Height balanced (AVL) tree, B-trees.

Unit-VI: Searching, Sorting and Complexity: Selection sort, Insertion sort, Bubble sort, Quick sort, merge sort, Heap sort, Radix sort and their complexity, Searching: Sequential search, Binary Search, Binary Search Tree, ASVL trees, B trees, Searching , sorting and complexity, Searching : Sequential and binary searches, Indexed search, Hashing Schemes. Sorting: Insertion, selection, bubble, Quick, merge, radix, Shell, Heap sort, comparison of time complexity.

Unit-VII: Graphs: Graph representation: Adjacency matrix, Adjacency lists, Traversal schemes: Depth first search, Breadth first search. Spanning tree: Definition, Minimal spanning tree algorithms. Shortest Path algorithms (Prime's and Kruskal 's).

Text Books / Reference Books / Online Resources:

1. Hubbard John. R, "Schaum's outline of Data Structures with C++", Tata McGraw-Hill, 2007.
2. Langsam Y,.Augenstein M. J and Tanenbaum A. M, "Data Structures Using C and C++", Second Edition, Pearson Education, 2007.
3. Kruse R, Tonodo C.L. and Leung B, "Data Structures and Program Design in C", Pearson Education, 2007.
4. Horowitz E, Sahni S and Mehta D, "Fundamentals of Data Structures in C++," Galgotia Publiction, 2009.
5. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
6. Weiss M A, "Data Structures and Algorithm Analysis in C++", Pearson Education, 2007
7. Litvin G, "Programmking with C++ and Data Structures", Vikas Publishing House.

Practical

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).

4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration.
12. WAP to display fibonacci series (i)using recursion, (ii) using iteration.
13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion.
14. WAP to create a Binary Search Tree and include following operations in tree: (a) Insertion (Recursive and Iterative Implementation) (b) Deletion by copying (c) Deletion by Merging (d) Search a no. in BST (e) Display its preorder, postorder and inorder traversals Recursively (f) Display its preorder, postorder and inorder traversals Iteratively (g) Display its level-by-level traversals (h) Count the non-leaf nodes and leaf nodes (i) Display height of tree (j) Create a mirror image of tree (k) Check whether two BSTs are equal or not.
15. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
16. WAP to reverse the order of the elements in the stack using additional stack.
17. WAP to reverse the order of the elements in the stack using additional Queue.
18. WAP to implement Diagonal Matrix using one-dimensional array.
19. WAP to implement Lower Triangular Matrix using one-dimensional array.
20. WAP to implement Upper Triangular Matrix using one-dimensional array.
21. WAP to implement Symmetric Matrix using one-dimensional array.
22. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal
23. Write a function that will concatenate two circularly linked lists, producing one circularly linked list.
24. WAP to implement Breadth First Traversal(BFS)
25. WAP to implement Depth First Traversal(DFS)
26. WAP to implement Prime's Algorithm.
27. WAP to implement Kruskal 's Algorithm.

Semester - IV
Course Code : BCA/404/MJC-8
Course Title : Computer Networks (4 Credit)
Course Objectives:

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.

Learning Outcomes:

At the end of the course, the students will be able to:

- Understand and describe the layered protocol model.
- Describe, analyses and evaluate a number of datalink, network, and transport layer protocols.
- Program network communication services for client/server and other application layouts.
- Describe, analyses and evaluate various related technical, administrative and social aspects of specific computer network protocols from standards documents and other primary materials found through research.
- Design, analyses, and evaluate networks and services for homes, data centres, IoT/IoE, LANs and WANs.

Theory: 60 Lectures

Unit-I: Data Communications: Introduction, Communication Systems, Signal and data, Transmission modes, Synchronous and asynchronous transmission, Circuits, channels and multi channeling, Signaling, Encoding and decoding, Error detection and Recovery, Flow control, Sliding Window, Congestion Management, Multiplexing [FDM, TDM, CDM, WDM] and

Spreading [DS. FH], Concept of Modulation, Baseband versus Broadband; Pulse Code Modulation (PCM), Shift Keying [ASK, FSK, PSK, QPSK, DPSK]; Encoding techniques and CODEC; Classification of Modems, Standards and Protocols, Protocols used by Modem to Transfer files, Establishing a Connection (Internet connectivity); Digital Subscriber Loop (DSL)

Unit-II: Communication Network Fundamentals: Introduction, Switching techniques: Circuit Switching, Packet switching, Datagram, Virtual circuit and Permanent Virtual Circuit, Connectionless and connection oriented communication, Message switching, Cell switching (ATM); Telephone network signaling Network topologies, Layering the communication process, Open Systems Interconnection (OSI) model, Data encapsulation; Protocols, services and layering, PDU/SDU; TCP/IP suite, Hour-glass model, Internet Architecture and Protocol overview.

Unit-III: Media Access Control: Introduction, Access Techniques (STDM, FDMA, TDMA, Spread Spectrum techniques and CDMA, DSSS, FHSS), Media Access Control, Aloha and Slotted Aloha, Media Access Control Address, Polling, CSMA, CSMA/CA, CSMA/CD and Reservation Aloha, Digital hierarchies [SONET/SDH]

Unit-IV: Network Components: Introduction, LAN Hardware, LAN Operating Systems, Transmission Media: Guided Media (Twisted pair, Co-axial cable, Optical fiber), Unguided Media (Radio, VHF, microwave, satellite, Infrared); Fiber Optics Communication Components (Source, Channel Detector).

Unit-V: Layered Protocols OSI Model: Goals of layered protocols, network design problems, communication between layers, introduction to standard organizations and the OSI model, standards organizations, Layers of OSI, OSI status.

Unit-VI: Switching and Routing in Networks: Message switching, packet switching, when and when not to use packet switching, packet routing, and packet switching support to circuit switching networks.

Unit-VII: Link Control and MAC Protocols: Framing, Error Detection and Correction; Window-based Flow Control; Logical Link Control, HDLC Protocol, Point-to-Point Protocol (PPP), X.25 CCITT standard for packet data transmission; Media access control, Random Access Techniques, Scheduling Mechanisms.

Unit-VIII: Local Area Network (LAN): LAN topologies and protocols; IEEE 802 Standard; Ethernet (Standard, Fast, Gigabit), Token Ring, FDDI, Wireless LANs (802.11x); Connecting LANs: Repeaters, Bridges, Switches, Routers; Virtual LANs

Unit-IX: Wide Area Network (WAN): Network Layer Addressing and Routing concepts (Forwarding Function, Filtering Function); Routing Methods (Static and dynamic routing, Distributed routing, Hierarchical Routing); Distance Vector Protocol, Link State protocol, Open Shortest Path First (OSPF); Internet Protocol (IP): Addressing & Routing; Internet Control Message Protocol, (ICMP), Address Resolution Protocol (ARP), Dynamic Host Control Protocol (DHCP), Network Address Translation (NAT), IPv6, Mobile IP, Process-to-Process delivery in Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), congestion control, TCP/IP Reference Model and internetworking, example of TCP/IP operations, related protocols, Concept of ports and sockets.

Unit-X: The X.25 and supporting protocols: Features of X.25, Layers of X.25 and the physical layer, X.25 and the data link layer, X.25 standards, X.25 channel options, flow control principles.

Unit-XI: Application Protocols: Client/Server Model, Network File System (NFS), Remote Login: Telnet; File Transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP); E-mail system: Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP); World Wide Web (WWW), Domain Name System (DNS), DNS servers; Hyper Text system: Hyper Text Transfer Protocol (HTTP), Hyper Text markup Language (HTML)

Unit-XII: Wireless Networks: Radio Communications, Cellular Radio, Mobile Telephony (GSM & CDMA), Satellite Networks (VSAT), Mobile Adhoc Networks (MANET)

Unit-XIII: Security and Management: Cryptography, IPsec, SSL/TLS, PGP, secure HTTP, proxy, firewall, VPN; Simple Network Management Protocol (SNMP), Network policies.

Text Books / Reference Books / Online Resources:

1. Computer Networks- protocols, standards and Interfaces, Black U., P.H.I.
2. Computer Communication Networks, Stallings W., P.H.I.
3. Computer Networks, Tannembaum A. S., P.H.I
4. Data Communication and Computer Networks : Brijendra singh (PHI)
5. Data Communication and Networking, Behrouz A Forouzan, Tata McGraw-Hill, 2008
6. Data Communication and Computer Networks, Rajneesh Agrawal and Bharat Bhushan Tiwari, Vikas Publishing House Ltd., 2005.
7. Introduction to Data Communications and Networking, Tomasi Wayne, Pearson Education, 2007

Practical

1. Open Linux Terminal, explain when we use these networking Command?
   ip, route, arp, whois, ss
2. How to Create two different network using Router in Cisco Packet Tracer
3. How to differentiate between Router & Bridge in Cisco Packet Tracer
4. Socket Programming- UDP Client/Server Socket.
5. How to make Client Server Communication using Socket Progarmming?
6. Open Windows Terminal when we use these following Networking Commands? Ping, tracert, nslookup, ipconfig /all, netstat -a
7. Create a Simple LAN Connection using Cisco Packet Tracer.
8. Set a domain icis.org.in in a DNS Server & Create a WAN Communication from your device (PC, Laptop etc..) using Cisco Packet Tracer.
9. Socket Programming- TCP Client/Server Socket.
10. Write a Program to implement Caesar Cipher.
11. Open Linux Terminal, explain when we use these networking Command?
    Man, tcpdump, iwconfig, dig, tracepath
12. How to differentiate between Hub & Switch in Cisco Packet Tracer
13. Socket Programming- make a multithreaded socket server.
14. How to make Client Server Communication using Socket Programming?
15. Open Linux Terminal, explain when we use these networking Command?
    ifconfig, host, traceroute, mtr, ssh
16. Socket Programming- socket server with multiple Client.
17. Write a program to implement Affine Cipher.
18. Implement Bus Topology using Cisco Packet Tracer.
19. Implement Ring Topology using Cisco Packet Tracer.
20. Implement Mesh Topology using Cisco Packet Tracer.
21. Implement Star Topology using Cisco Packet Tracer.
22. Implement Hybrid Topology using Cisco Packet Tracer.
23. Implement Tree Topology using Cisco Packet Tracer.
24. Socket Programming- Sending and Receiving Data.
25. How to Use the FTP Command to Copy Files to/from a Server.
26. Create FTP Server using Cisco Packet Tracer.
27. Write a Program to Implement RSA Algorithm.
28. Write a Program to Implement Hill Cipher.
29. Write a Program to Implement Row Transposition Cipher.
30. Write a Program to Implement CRC Error Detection.

Semester - IV
Course Code: BCA/405/MN-4A
Course Title: Fuzzy Logic and its Applications (4 Credit)

Course Objectives:

- To develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
- To lean about the fuzzification of scalar variables and the defuzzification of membership functions.
- To learn three different inference methods to design fuzzy rule based system.
- To develop fuzzy decision making by introducing some concepts and also Bayesian decision methods.
- To learn different fuzzy classification methods.

Learning Outcomes:

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

- Understand the basic ideas of fuzzy sets, operations and properties of fuzzy sets and also about fuzzy relations.
- Understand the basic features of membership functions, fuzzification process and defuzzification process.
- Design fuzzy rule based system.
- Know about combining fuzzy set theory with probability to handle random and non-random uncertainty, and the decision making process.
- Gain the knowledge about fuzzy C-Means clustering.

Theory: 60 Lectures

Unit-I: Classical sets: Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets.

Unit-II: Classical and Fuzzy relations: Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

Unit-III: Fuzzification and Defuzzification: Features of the membership functions, various forms, fuzzification, defuzzification to crisp sets, - cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, other forms of the implication operation

Unit-IV: Fuzzy Systems: Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories

Unit-V: Fuzzy decision making: Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions

Unit-VI: Fuzzy Classification: Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition.

Text Books / Reference Books / Online Resources:

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley, 2010.
2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi, 1995.
3. S.Rajasekaran, G.A.Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms,
4. Synthesis and Applications, PHI, New Delhi, 2003.

Semester - IV

Course Code: BCA/405/MN-4B

Course Title: Data Modeling and Design (4 Credit)

Course Objectives:

The purpose of this course is to provide a comprehensive introduction to database modeling and design implementing the Database Systems Development Life Cycle. The course will define and use essential database terms and concepts. The

emphasis of the course is on the design and use of a relational database. The student will analyze complex business scenarios, and design and create models to support said scenario.

Learning Outcomes:

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

- Describe the importance of information within an organization.
- Understand the Systems Development Life Cycle.
- Describe the process of modeling business requirements.
- Apply business concepts to a data model.
- Understand the concept of data normalization.
- Analyze user information requirements to develop an entity relationship model.
- Design and interpret conceptual data models.
- Develop a relational database design using an Entity Relationship Model.
- Identify and correct poor database designs.
- Describe Structured Query Language.
- Describe Data Warehouse databases.
- Understand data types and data objects, and define their use in Object-Oriented databases

Theory: 60 Lectures

Unit-I: Introduction to Database Technologies: Systems Development Life Cycle, Identify Business Requirements, Entity Relationship Data Modeling, Normalization, Advanced Data Modeling Concepts, Transform a Data Model into a Functional Database, Structured Query Language, Database Management Concepts, Data Warehousing, Object-Oriented Concepts.

Unit-II: Introduction to Database Concepts: Learn the history of data processing, Learn the history of databases, Learn essential database vocabulary, Understand the need to develop database systems, Understand the current position of database systems in organizational success.

Unit-III: Systems Development Life Cycle: Learn the Systems Development Life Cycle.

Unit-IV: Identifying Business Requirements: Describe the process of modeling business requirements, Determine entities among data requirements, Determine the attributes associated to entities, Determine the interrelatedness of entities / business matters of importance.

Unit-V: Entity Relationship Data Modeling: Understand the Data Modeling Process including scope definition and requirements, Define Entity, Attribute and Relationship, Convert a business rule to a ERD relationship, Illustrate the entities, attributes and relationships in an accurate ERD accurate graphic representation, Explain relationship's ordinality, Explain relationship's cardinality/degree, Verbalize the Entity Relationship Diagram's notation.

Unit-VI: Normalization: Define Normalization, Describe Normalization, Resolve a many – to – many relationship, Create an Entity Relationship Diagram in 3rd Normal Form.

Unit-VII: Advanced Data Modeling Concepts: Understand and model subtypes and supertypes, Understand and model hierarchical data, Understand and model recursive relationships, Understand and model historical data.

Unit-VIII: Transform a Data Model into a Functional Database: Distinguish between a conceptual model and a physical model, Define relational database terminology, Relate the conceptual design to a physical mode, Map entities and attributes, Define Primary Keys, Map relationships to Foreign Keys.

Unit-IX: Structured Query Language: Describe Structured Query Language, Demonstrate basic syntax in SQL (SELECT, FROM), Demonstrate selecting specific rows of data / projection (WHERE), Understand how to show a table design (DESCRIBE).

Unit-X: Data Warehousing: Describe Data Warehousing, Understand the difference between a transactional database and a data warehouse.

Unit-XI: Object Oriented Concepts: Define an object, Define an object orientated database.

Text Books / Reference Books / Online Resources:

1. Data Modeling Essential the Ultimate Reference, by Graeme C. Simsion, Dreamtech Press
2. Data Modeling Made Simple: A Practical Guide for Business and IT Professionals, Steve Hoberman, Originally Published.
3. Data Modeling: A Beginner's Guide, Andy Oppel, Originally Published.

Semester - IV
Course Code: BCA/405/MN-4C
Course Title: Cyber Security Techniques (4 Credit)
Course Objectives:
To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks. To develop graduates that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.
Learning Outcomes:
After the completion of this course, the students will be able to:

- Protect and defend computer systems and networks from cybersecurity attacks. ...
- Diagnose and investigate cybersecurity events or crimes related to computer systems and digital evidence.
- Effectively communicate in a professional setting to address information security issues.

Theory: 60 Lectures

Unit-I: Information Security Basics to Policy, Cybercrime and different modes of attacks, Intrusion detection system IT Assets and Wireless Security

Unit-II: Cyber Security Assurance Framework, Desktop Security and Malware, E-Commerce and Web-Application Security, Social Engineering.

Unit-III: Cyber Security Risk Management, Computer Forensics Fundamentals and Collection of Digital Evidence, Cyber Security Initiatives in India, Cyber Security Strategies and Policies.

Unit-IV: Network Security Threats, Network Security Technologies, Network Security – Controls and Best Practices, Network Security (Physical and Environment Security).

Text Books / Reference Books / Online Resources:

1. Cyber Security : Learn All the Essentials and Basic Ways to Avoid Cyber Risk for Your Business (Cybersecurity Guide for Beginners), Ben Chan.
2. Cybersecurity for Dummies, Joseph Steinberg.
3. Cyber Security, Notion Press.

Semester - IV
Course Code: BCA/405/MN-4D
Course Title: Software Designing (4 Credit)
Course Objectives:
During this course, students will:

- Discover how architecture influences (and is influenced by) technical environments, project lifecycles, business profiles and practices.
- Explore how various software quality attributes (i.e., reliability, usability, compatibility, interoperability, etc.) can influence the architecture and design of a software product.
- Leverage appropriate software design patterns, interfaces, and practices for optimizing quality of a software product through its carefully planned architecture and design.

- Use Agile development practices and the Unified Modeling Language (UML) in the development of a semester software design project.
- Architect and design a software product either for a mobile, cloud, embedded, or other type of software product.
- Investigate how to scale software systems, using evolutionary software development methodologies such as DevOps, software product lines, and/or deployment pipelines.

Learning Outcomes:

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

- Develop the architectural, interface and component design elements for a comprehensive software design that meets specified design requirements.
- Collaborate with other students in a team setting using industry representative team collaboration methodologies to complete the software design.
- Document a software design using Unified Modeling Language (UML) architectural views and design constructs (i.e., sequence diagrams, deployment diagrams, timing diagrams, state transition diagrams, etc.).
- Select standard quality attributes to influence a product's software design.
- Architect /design a software product for a mobile, cloud, or embedded application
- Select common software design patterns used to develop software designs that meet specified requirements and quality attributes.

Theory: 60 Lectures

Unit-I: Introduction to Software Design: Describe software design engineering activities. • Compare and contrast software architecture and detailed design. • Evaluate the role of the SDLC Design phase in the production of high quality, sustainable software.

Unit-II: Understanding Software Architecture: Explain the importance of software architectural design. • Compare and contrast different architectural views to capture a software design.

Unit-III: Software Quality Attributes: Describe common software quality attributes. • Participate in a software quality attribute workshop (QAW) to select the quality attributes most important in a software design.

Unit-IV: Software Design Patterns and Interface Design: Connect software architectural elements to detailed design elements. • Describe basic strategies of using object-oriented design techniques. • Compare and contrast common software design patterns. • Develop software interface design solutions.

Unit-V: Documenting a Software Architecture and Design: Describe how graphical models and UML are used to capture the design of a software system and its behavior • Capture a software design in a UML modeling tool.

Unit-VI: Scalable Software Architecture and Design: Incorporate open-source or reused software into software design. • Develop a plan to scale a software system, using evolutionary software development methodologies such as DevOps, software product lines, and/or deployment pipelines.

Unit-VII: Evaluating a Software Architecture and Design: Evaluate a software architecture for a given set of attribute-specific measures for a software system. • Conduct a software architecture review with stakeholders and an evaluation team. • Map architectural and design approaches to prioritized quality attributes. • Identify sensitivity points and tradeoff points of achieving specified quality attributes.

Unit-VIII: Conducting a Software Design Review: Prepare a software design presentation. • Conduct a software design review with a panel of subject matter experts. • Disposition any resulting actions from the software design review.

Text Books / Reference Books / Online Resources:

1. Software Design, David Budgen, Pearson Education India.
2. Software Architecture by Subodh Prasad, S.K. Kataria & Sons

Semester - IV

BANKURA UNIVERSITY

Curriculum and Credit Framework for BCA Programme

(Basic, Honours and Honours with Research)

Course Code: BCA/407/INT-2
Course Title: Summer Internship (4 Credit)
Course Objectives:
Acquire on job the skills, knowledge, and attitude, which are requisite to constitute a professional identity. Demonstrate professional values and ethical standards.
Learning Outcomes:
After the completion of this course, the students will be able to:

- Student is able to construct the company profile by compiling the brief history, management structure, products / services offered, key achievements and market performance for his / her organization of internship.
- For his / her organization of internship, the student is able to assess its Strengths, Weaknesses, Opportunities and Threats (SWOT).
- Student is able to determine the challenges and future potential for his / her internship organization in particular and the sector in general.
- Student is able to test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
- Student is able to apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
- Student is able to analyze the functioning of internship organization and recommend changes for improvement in processes.

Guidelines for Summer Training Report Writing

Viva Voce on Summer Training is an important part of BCA course curriculum. It providesan opportunity to BCA students to write a summer training report on latest trends/technology related to software project. Following are guidelines for summer training report writing and assessment:

General Instructions

- Summer training report should not be less than 15 pages.
- Proper guidelines to be followed for preparation of summer training report.
- Proper dress code is mandatory for presenting and attending summer training PPT presentations.
- Attendance is compulsory for all students.
- If a student is absent for his presentation as per schedule, he/she must have assessed later on with reducedweightage in the presentation assessment.
- Always prepare a draft report first and print it out.
- Read it yourself first and correct any typographical or grammatical errors.
- **One copy** of final summer training report must be submitted as a **spiraled report** to the coordinator.

Main Components of a Report

- **Cover page**
  As per the given format.
- **Abstract**
  Abstract should be a narration of Problem Definition, Methodology used in third person's language not exceeding 200 words.
- **Acknowledgement and declaration**

The Acknowledgement shall be brief and should not exceed one page. The students' signature shall bemade at the bottom end above their name typed in capital.

- **Certificate**
  Attach a photocopy of a certificate issued from where training has been done.

- **Table of contents/Index page**
  The table of contents should list all material following it. The abstract, acknowledgement will be included in table of contents but the page numbers in lower case Roman letters are to be accounted forthem. Pages starting with Introduction (Immediate after the Table of contents) should be consecutivelynumbered using Arabic Numerals.

- **Main Text with conclusions**
  This includes various sections for Summer Training Report.

- **References**

Typing Instructions for Summer Training Report

- **Specification for Fonts**
  - **Font Face: Times new Roman**
  - **Font Size:** As per following preview
    - **Headings (Size 16 Bold)**
    - **Sub-Heading (Size 14 Bold and Italic)**
    - **Contents (Size 12 Normal)**
  - **Line spacing: 1.5**
  - **Text Alignment: Both left and right justified**
- Page Dimensions: Standard A4 size (297mm x 210mm)
- Margins:
  - **Top margin: 0.75”**
  - **Bottom margin: 0.75”**
  - **Left margin: 1”**
  - **Right margin: 0.75”**

  Footer: Page number should be bottom centered.

  - Sections should be numbered as for example,**1. Introduction** etc.
  - Subsections should be numbered as for example,***3.1 Simulation Tool*** etc.
  - Paragraphs and sentences should be short.
  - Start of a paragraph should not be intended, rather, give one-line space between two paragraphs.
  - A sub heading at the bottom of a page must have at least two full lines below it or else it should becarried over to the next page.
- The last word of any page should not be split using a hyphen.

  References

- References should be in IEEE format, i.e.,
  - Author name(s), title of paper/book, or if journal, its name, volume, issues, page number,publisher, year of publication
- Book titles must be in capitals
- Reference numbers should be marked liberally inside the text of the report-
  - eg., ……as given in [3]

References should either be in chronological order or in the order in which they appear in thetext.

========== XXX =========