Karmaveer Bhaurao Patil University,

Satara

Syllabus for

B. Sc. I Computer Application

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

1. INTRODUCTION

The B.Sc. Computer Applications Programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles along with broad based general education. This would enable the graduates completing B.Sc.to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

The proposed B.Sc. Programme in Computer Applications will be a judicious mix of skills, professional education related to Software Applications and alsoappropriate content of general education. It is designed with the objective of equipping the students to scope with the emerging trends and challenges in the Software Industries.

2. ELIGIBILITY FOR ADMISSION

Eligibility for admissions and reservation of seats for B.Sc. Computer Applications shall be according to the rules framed by the University from time to time.No student shall be eligible for admission to B.Sc. Computer Applications unless he/she has successfully completed the examination conducted by a Board/ University at the +2level of schooling or its equivalent in science stream.

3. NATURE OF THE COURSE

This course follows 2(b) pattern of the University under first degree CBCSprogram with appropriate modifications.

- Open course is envisaged
- Electives are include
- Total credits enhanced to 176.
- Multiple exit points are permitted, that is, if willing, candidate can quit after thesuccessful completion of first & second year. Candidate do so, can't be re- entered..

CURRICULUM

The curriculum in each of the years of the Programme would be a suitablemix of general education and skill development components.

Department of B.Sc. Computer Applications
"NEP Implementation 2020"
BSc. Computer Applications
Semester : I

Sr. No.	Course	Name of the course	Subject Code	Name of the Paper	Credits
1	Course 1	DSC -I	BCAT 111	Computer Fundamental & Application	2
		DSC -II	BCAT 112	Concept of Operating System	2
		DSC (P) -I	BCAP 113	Lab Based on Computer Fundamental & Application and Concept of Operating System	2
2	Course 2	DSC -I	BCAT 114	Fundamentals of Computational Electronics	2
		DSC -II	BCAT 115	Computational Digital Electronics - I	2
		DSC (P) -I	BCAP 116	Lab Based on Fundamentals of Computational Electronics and Computational Digital Electronics - I	2
3	Course 3	DSC -I	BCAT 117	Computational Mathematics - I	2
		DSC -II	BCAT 118	Computational Statistics -I	2
		DSC (P) -I	BCAP 119	Lab Based on Computational Mathematics – I and Computational Statistics -I	2
4	Open Elective	OE-1	BCATOE I	Environmental Studies – I	2
5	IKS-I	Generic	BCATIKS I	Introduction to Indian Knowledge System	2
				Total	22

Semester : II

Sr. No.	Course	Name of the course	Subject Code	Name of the Paper	Credits
1	Course	DSC –	BCAT	Computer Programming	2

	1	III	121	– I	
		DSC – IV	BCAT 122	Database Management System	2
		DSC (P) -II	BCAP 123	Lab Based on Computer Programming – I and Database Management System	2
2	Course 2	DSC – III	BCAT 124	Integrated Circuits For Computational Application	2
		DSC – IV	BCAT 125	Computational Digital Electronics - II	2
		DSC (P) - II	BCAP 126	Lab Based on Integrated Circuits for Computational Application and Computational Digital Electronics - II	2
3	Course 3	DSC – III	BCAT 127	Computational Mathematics - II	2
		DSC – IV	BCAT 128	Computational Statistics -II	2
		DSC (P) - II	BCAP 129	Lab Based on Computational Mathematics – II and Computational Statistics -II	2
4	Open Elective	OE - 2	BCATOE II	Environmental Studies – II	2
5	VEC – I	DEIC	BCATIKS II	Democracy, Election and Indian Constitution	2
				Total	22

SEMESTER-I

DSC I:

BCAT – 111 : Computer Fundamentals & Applications

Course Objectives: Student should be able to …

1. Understand fundamental of computers.
2. Describe the concepts Central Processing Unit.
3. Understand the concept of computer language.
4. Learn the concept of Microsoft Office.

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Introduction to Computer**	**8**
	• Introduction to Computer • Characteristics of Computer • Applications of Computer • Generation of Computer • Types of Computers • Components of Computer System • Advantages of Computer • Limitations of Computer	
Unit II	**Computer Memory and Computer Language**	**8**
	Computer Memory : • Introduction • Memory Hierarchy • Processor • Registers • Cache Memory **Computer Language**: • Machine Language • Assembly Language • High Level Languages	
Unit III	**MS – Word and MS – Excel**	**8**
	• Introduction • Shortcuts • Working and Formatting with Documents • Creating Tables • Macros • Mail merge • Printing Documents **MS-EXCEL** – • Introduction to Excel • Sorting • Queries • Graphs	

	• Scientific functions.	
Unit IV	**MS – PowerPoint and MS - Access**	**6**
	• **POWERPOINT** : • Introduction to Power Point • Creation of Slides • Inserting pictures • Preparing slide show with animation. • **MS - ACCESS :** • Creation • Manipulation of Files.	

Course Outcomes: Student will be able to …

1. Explain the basic concepts of computer
2. Use block diagram Central Processing Unit
3. Compare different computer language
4. Use different Microsoft tool.

REFERENCE Books:

1. P.K. Sinha, Priti Sinha, *Computer Fundamentals*, BPB Publications, 6th Edition, 2010.
2. V. Rajaraman, *Fundamentals of Computers*, PHI Learning, 6th Edition, 2014.
3. Anita Goel, *Computer Fundamentals*, Pearson, 1st Edition, 2010.
4. Alexis Leon, Mathews Leon, *Introduction to Computers with MS-Office 2000*, Tata McGraw-Hill, 1st Edition, 2000.
5. Madhulika Jain, Satish Jain, *Computer Applications in Management*, V.K. (India) Enterprises, 1st Edition, 2007.
6. Peter Norton, *Introduction to Computers*, McGraw-Hill Education, 7th Edition, 2017.

DSC II: BCAT 112: Concept of Operating System

Course Objectives: Student should be able to …

1. Understand the basics and functions of Operating System.
2. Learn various memory management schemes.
3. Study Scheduling Algorithm and process Synchronization.
4. Understand Processes and threads.

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Introduction to Operating System**	**8**
	• Computer System • Elements and organization • Operating System Overview • Objectives and Functions • Evolution of Operating System • Operating System Structures • Operating System Services • User Operating System Interface • System Calls – System Programs • Design and Implementation - Structuring methods.	
Unit II	**Process Management**	**8**
	• Processes - Process Concept • Process Scheduling • Operations on Processes • Inter-process Communication • Deadlock - Methods for handling deadlocks • Deadlock prevention • Deadlock avoidance • Deadlock detection • Recovery from deadlock.	
Unit III	**Memory Management**	**6**
	• Main Memory wrapping • Contiguous Memory Allocation • Paging - Structure of the Page Table • Segmentation • Segmentation with paging • Virtual Memory - Demand Paging • Copy on Write - Page Replacement • Allocation of Frames –Thrashing.	
Unit IV	**Storage Management**	**8**

	• Mass Storage system • Disk Structure - Disk Scheduling and Management • File-System Interface • File concept • Access methods • Directory Structure - Directory organization • File system mounting - File Sharing and Protection • File System Implementation - File System Structure • Directory implementation - Allocation Methods • Free Space Management • I/O Systems – I/O Hardware • Application I/O interface • Kernel I / O subsystem.	

Course Outcomes: Student will be able to …

1. Analyze various scheduling algorithms and process synchronization.
2. Explain deadlock prevention and avoidance algorithms.
3. Compare and contrast various memory management schemes.
4. Explain the functionality of file systems, I/O systems, and Virtualization

REFERENCE BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, *Operating System Concepts*, Wiley, 10th Edition, 2018.
2. William Stallings, *Operating Systems: Internals and Design Principles*, Pearson, 9th Edition, 2017.
3. Andrew S. Tanenbaum, Herbert Bos, *Modern Operating Systems*, Pearson, 4th Edition, 2014.
4. Charles Crowley, *Operating Systems: A Design-Oriented Approach*, Tata McGraw-Hill, 1st Edition, 1997.
5. Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, *Operating Systems*, Pearson, 3rd Edition, 2003.
6. D.M. Dhamdhere, *Operating Systems: A Concept-Based Approach*, McGraw-Hill Education, 3rd Edition, 2012.
7. Achyut S. Godbole, Atul Kahate, *Operating Systems*, McGraw-Hill Education, 3rd Edition, 2016.

LAB-I: BCAP 113 : Based on BCAT 111 and BCAT 112

Computer Fundamentals & Application and Concepts of Operating System.

Course Objectives: Students should be able to….

1. Understand Computer Fundamentals – hardware and Software.
2. Understand computer Architecture.
3. Study Office automation tools.
4. Learn Basic Number System.

Credits (Total Credits 2)	SEMESTER - I LAB COURSE – I : BCAP 113 Computer Fundamentals & Applications + Concepts of Operating System	No. of hours 60 Hrs.
	Computer Fundamentals & Application	
1	Searching for a web site / application / text documents viewing and downloading	**2**
2	Create an E-mail account, retrieving messages from inbox, replying, attaching files filtering and forwarding	**2**
3	Preparing a Govt. Order / Official Letter / Business Letter / Circular Letter Covering formatting commands - font size and styles - bold, underline, upper case, lower case, superscript, subscript, indenting paragraphs, spacing between lines and characters, tab settings etc.	**2**
4	Preparing a newsletter: To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.	**2**
5	Creating and using styles and templates to create a style and apply that style in a document to create a template for the styles created and assemble the styles for the template.	**2**
6	Creating and editing the table to create a table using table menu to create a monthly calendar using cell editing operations like inserting, joining, deleting, splitting and merging cells to create a simple statement for math calculations viz. Totaling the column.	**2**
7	Creating numbered lists and bulleted lists to create numbered list with different formats (with numbers, alphabets, roman letters) To create a bulleted list with different bullet characters.	**2**
8	Printing envelopes and mail merge. To print envelopes with from addresses and to addresses To use mail merge facility for sending a circular letter to many persons To use mail merge facility for printing mailing labels.	**2**
9	Using the special features of word to find and replace the text To spell check and correct. To generate table of contents for a document to prepare index for a document.	**2**
10	Create an advertisement Prepare a Template. Prepare a Corporate Circular letter inviting the shareholders to attend the Annual Meeting in PowerPoint.	**2**
11	Creating a new Presentation based on a template – using Auto content wizard, design template and Plain blank presentation	**2**
12	Creating a Presentation with Slide Transition – Automatic and Manual with different effects.	**2**
13	Creating a Presentation applying Custom Animation effects – Applying multiple effects to the same object and changing to a different effect and removing effects.	**2**
14	Creating and Printing handouts.	**2**
15	Creating a table in Excel and perform various mathematical operation on it.	**2**

Concepts of Operating System		
1	Study of Different OS Installation and its working.	**2**
2	Study of Basic commands to understand the system and working of Linux.	**2**
3	To make folder and subfolder.	**2**
4	To make directory and subdirectory.	**2**
5	To show system Date and Time.	**2**
6	To show Internal Protocol Configuration.	**2**
7	To show System Information.	**2**
8	Any 10 commands of Linux.	**2**
9	Write a menu driven shell script which will print the following menu and execute the given task. 1. Display calendar of current month 2. Display today's date and time 3. Display usernames those are currently logged in the system 4. Display your name at given x, y position 5. Display your terminal number	**2**
10	Write a shell script to read n numbers as command arguments and sort them in descending order.	**2**
11	Write a program for process creation using C. (Use of gcc compiler).	**2**
12	Write a shell script to check entered string is palindrome or not.	**2**
13	Study of Advance commands and filters of Linux/UNIX	**2**
14	Write an awk program using function, which convert each word in a given text into capital.	**2**
15	Write a shell script to find factorial of given number n.	**2**

Course Outcomes: Students will be able to….

1. Create email and send mail.
2. Write basic program.
3. Write basic command.
4. Operate Windows operating system, Linux Operating System.

REFERENCE BOOKS:

1. **Anita Goel**, *Computer Fundamentals and Applications*, Pearson, 1st Edition, 2010.
2. **Madhulika Jain, Satish Jain**, *PC Software for Windows 10 and Office 2016 Made Simple*, BPB Publications, 1st Edition, 2017.
3. **Ramesh Bangia**, *Learning Computer Fundamentals, MS Office, and Internet & Web Technology*, Firewall Media, 2nd Edition, 2011.
4. **Vikas Gupta**, *Comdex Computer Course Kit: Windows 10 with MS Office 2016*, Dreamtech Press, 2017.
5. **Abraham Silberschatz, Peter Baer Galvin, Greg Gagne**, *Operating System Concepts with Java*, Wiley, 8th Edition, 2013. (Comes with practical exercises)
6. **Achyut S. Godbole, Atul Kahate**, *Operating Systems*, McGraw-Hill Education, 3rd Edition, 2016. (Includes lab exercises and practical aspects)
7. **Andrew S. Tanenbaum**, *Operating Systems Design and Implementation*, Pearson, 3rd Edition, 2006. (Contains detailed practical implementation aspects)

BCAT-114: Fundamentals of Computational Electronics

Course Objectives: Student should be able to …

1. To familiarize students with fundamental electronic components such as resistors, capacitors, diodes, and transistors.
2. To teach students basic principles of circuit analysis including Ohm's Law, Kirchhoff's Laws, and circuit simplification techniques.
3. To Introduce students to Motherboard, PCB Design and Power Supply Components.
4. To explain the Interfacing Connection.

SYLLABUS: **Credit: 02**

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Foundations and Evolution of Electronics in Computing**	**8**
	• **Introduction to Electronic Components:** Overview of basic components, Importance in electronic circuits • **Resistors:** Function and types of resistors, Applications in circuits • **Capacitors:** Function and types of capacitors, Applications in circuits • **Diodes:** Function and types of diodes, Applications in circuits • **Transistors:** Function and types of transistors, Applications in circuits • **Role of Electronic Components in Circuits:** How components work together	
Unit II	**Fundamentals of Circuit Theory**	**8**
	• **Introduction to Circuit Theory:** Basic concepts and terminology, Importance in electronics • **Ohm's Law:** Explanation and mathematical formulation. • **Kirchhoff's Laws -** Applications in circuit analysis, practical example • **Series Circuits, Parallel Circuits:** Characteristics and analysis, Practical examples • **Thevenin, Norton Theorem, Maximum power transfer theorem:** Characteristics and analysis, Practical examples	
Unit III	**Motherboard, PCB Design and Power Supply Components**	**8**
	• **Printed Circuit Boards (PCBs):** Function, Providing physical and electrical connections for components, Layers: Single-layer, multi-layer boards • **Motherboard:** Function: Main circuit board housing critical components, Key Sections: CPU socket, memory slots, expansion slots, power connectors • **Power Supply Unit (PSU):** Function: Converting AC to DC power, providing stable power to components half wave, full wave, Linear, switching power supplies • **Voltage Regulators:** Function: Maintaining constant voltage levels,	

	Applications: Power management in various computer sections, Zener, transistorized regulators • **SMP and UPS**: Introduction, types, Block diagram and explanation	
Unit IV	**Interfacing and Connectivity**	**6**
	• **Buses:** Function ,Types: Data bus, address bus, control bus • **Connectors and Ports:** Function, Providing external connectivity, Types: USB (USB 2.0, 3.0, 3.1, and USB4), HDMI, Ethernet (10/100/1000 Mbps, Gigabit Ethernet), SATA	

Course Outcomes: Student will be able to …

1. Students will be able to identify and explain the function of these components in electronic circuits.
2. Students will be able to analyze simple DC and AC circuits to determine voltage, current, and power relationships.
3. Students will understand how digital signals are processed and manipulated in computers and other digital devices.
4. Students will comprehend the methods used to convert signals between analog and digital formats in various applications.

REFERENCE BOOKS:

1. Mark S. Lundstrom, *Fundamentals of Carrier Transport*, Cambridge University Press, 2nd Edition, 2000.
2. Dragica Vasileska, Stephen M. Goodnick, *Computational Electronics*, Morgan & Claypool Publishers, 1st Edition, 2006.
3. Robert W. Dutton, *Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation*, Springer, 1st Edition, 1993.
4. David K. Ferry, *Transport in Nanostructures*, Cambridge University Press, 2nd Edition, 2009.
5. Suhas V. Patankar, *Numerical Heat Transfer and Fluid Flow*, Hemisphere Publishing Corporation, 1st Edition, 1980. (Useful for computational techniques in electronics)
6. David A. Neamen, *Semiconductor Physics and Devices: Basic Principles*, McGraw-Hill Education, 4th Edition, 2011.
7. Mitiko Miura-Mattausch, Hans-Joachim Mattausch, *The Drift Diffusion Equation and Its Applications in MOSFET Modeling*, World Scientific Publishing Company, 1st Edition, 2011.

BCAT-115: Computational Digital Electronics- I

Course Objectives: Student should be able to …

1. To introduce students to the principles of digital logic including Boolean algebra, logic gates, and truth tables.
2. To teach students Number System for digital applications.
3. To explore sequential Combinational circuits including flip-flops, counters, and state machines.
4. To enable students to design and simulate digital systems for logic gates.

SYLLABUS: **Credit: 02**

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Computer Number System**	**8**
	• I**ntroduction**: Overview of number system. • **Study of Number System.** - Binary Number system - Decimal number system - Octal number system - Hexadecimal Number system and conversions. • **Code:** ASCII code, EBCDIC code, parity code	
Unit II	**Logic Gates and Boolean Algebra**	**8**
	• **Introduction:** Concept, Classification of logic gates. • **Logic Gates:** AND, OR, NOT, NAND, NOR, XOR, XNOR gates • **Universal Gate:** NOR, NAND Gate. • **Introduction to Boolean algebra:** Boolean Laws and Rules (commutative, Associative, distributive law's) and Logic Families: Introduction to digital logic family such as RTL, DTL, TTL	
Unit III	**Arithmetic Circuit**	**6**
	• **Introduction:** arithmetic Circuit. • **Importance:** arithmetic circuit. • **Binary arithmetic:** Addition, subtraction, Multiplication, Duvision. • **Adder:** Half adder, Full adder, Parallel half adder, parallel full subtractor. • **Subtractor:** Half subtractor, full subtractor • Parallel Adder • Multipliers and Divider	
Unit IV	**Combinational Circuit**	**8**
	• **Multiplexer:** 2:1 MUX, 4:1 MUX, 8:1 MUX. • **De-multiplexer:** 1:2 De-MUX, 1:4 MUX, 1:8 MUX. • **Design and Implement Encoder Decoder:** Priority Encoder. • Design and Implement Decoder • **Comparator:** 1- bit and 4-bit Comparator. • **Code Converter:** Binary to Gray and Gray to Binary.	

Course Outcomes: Student will be able to …

1. Students will be able to design, analyze, and optimize basic digital circuits using Boolean expressions and logic gates.
2. Students will verify truth table using digital designs on hardware platforms.
3. Students will understand the behavior of sequential circuits and their applications in digital systems such as Encoder, Decoder and multiplexer, de- multiplexer.
4. Students will be able to use software tools (e.g., FPGA design software, circuit simulation tools) to simulate and validate digital designs before implementation.

REFERENCE BOOKS:

. Mark S. Lundstrom, *Fundamentals of Carrier Transport*, Cambridge University Press, 2nd Edition, 2000.

2. Dragica Vasileska, Stephen M. Goodnick, *Computational Electronics*, Morgan & Claypool Publishers, 1st Edition, 2006.
3. Robert W. Dutton, *Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation*, Springer, 1st Edition, 1993.
4. David K. Ferry, *Transport in Nanostructures*, Cambridge University Press, 2nd Edition, 2009.
5. Suhas V. Patankar, *Numerical Heat Transfer and Fluid Flow*, Hemisphere Publishing Corporation, 1st Edition, 1980. (Useful for computational techniques in electronics)
6. David A. Neamen, *Semiconductor Physics and Devices: Basic Principles*, McGraw-Hill Education, 4th Edition, 2011.
7. Mitiko Miura-Mattausch, Hans-Joachim Mattausch, *The Drift Diffusion Equation and Its Applications in MOSFET Modeling*, World Scientific Publishing Company, 1st Edition, 2011.

LAB-I: BCAP 116 : Based on BCAT 114 and BCAT 115

Fundamentals of Computational Electronics + Computational Digital Electronics- I

Course Objectives: Students will be able to….

1. Understand Fundamentals of Electronics – hardware
2. Learn How to Design hardware.
3. Understand the basic of logic.
4. Study Digital electronics.

Credits (Total Credits 2)	SEMESTER - I LAB COURSE – I : BCAP 116 Computational Mathematics – I + Computational Electronic and Hardware – I	No. of hours 60 Hrs.
	Computational Mathematics – I	
1	Study of Electronics Components and Tools.	**2**
2	Study of Resistor color code technique.	**2**
3	Study of the ohms law.	**2**
4	Kirchhoff's law with an example.	**2**
5	Study of the I-V characteristics of Diode.	**2**
6	Study of the thevinins theorem and Nortons theorem.	**2**
7	Design and study 5v regulated power supply.	**2**
8	Study of different types of connectors.	**2**
9	Study of different types of bus(Data bus,address bus)	**2**
10	Study the voltage source in series and parallel combination.	**2**
	Computational Electronic and Hardware – I	
1	Study of adder circuit(half adder and full adder)	**2**
2	Study of subtractor circuit(half subtractor and full subtractor)	**2**
3	Study of Logic Gates (AND, OR, NOT).	**2**
4	Study of Universal Gates.	**2**
5	Study and Design 4:1Multiplexer circuit.	**2**
6	Study and Design 1:4Demultiplexer Circuit.	**2**
7	Study of code converter technique.	**2**
8	Study of the Encoder Circuit	**2**
9	Study of Decoder Circuit.	**2**
10	Study of the comparator circuit.	**2**

Course Outcome: Students should be able to….

1. Understand the Conversions of number systems.
2. Develop the concept of digital electronics.
3. Understand the different electrical component.
4. Understand the foundations of mathematics.
5. Develop and maintain problem- solving skills.

REFERENCE BOOKS:

1. Mark S. Lundstrom, *Fundamentals of Carrier Transport*, Cambridge University Press, 2nd Edition, 2000.
2. Dragica Vasileska, Stephen M. Goodnick, *Computational Electronics*, Morgan & Claypool Publishers, 1st Edition, 2006.
3. Robert W. Dutton, *Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation*, Springer, 1st Edition, 1993.
4. David K. Ferry, *Transport in Nanostructures*, Cambridge University Press, 2nd Edition, 2009.
5. Suhas V. Patankar, *Numerical Heat Transfer and Fluid Flow*, Hemisphere Publishing Corporation, 1st Edition, 1980. (Useful for computational techniques in electronics)
6. David A. Neamen, *Semiconductor Physics and Devices: Basic Principles*, McGraw-Hill Education, 4th Edition, 2011.
7. Mitiko Miura-Mattausch, Hans-Joachim Mattausch, *The Drift Diffusion Equation and Its Applications in MOSFET Modeling*, World Scientific Publishing Company, 1st Edition, 2011.

BCAT-117: Computational Mathematics - I

Course Objectives: Student will be able to …

1. Understand recursive techniques to count element of set and knowledge of set theory.
2. Solve simple application problems related to computer based on these.
3. Construct simple mathematical proofs and possess ability to verify them
4. Learn the concept of Divisibility of integers

SYLLABUS: **Credit: 02**

No of Credits: 2	B.Sc. I (Computer Application) Sem I Computational Mathematics - I	No of Hours (30)
Unit I	**Logic**	**8**
	• Introduction, Definition: Statement (Proposition). • Types of Statements: Simple and compound statements, Truth values of a statement, Truth Tables and construction of truth tables. • Logical Operations: Negation, Conjunction, Disjunction, Implication, Double Implication, Equivalence of Logical statements. • Statement forms: Tautology, Contradiction, and Contingency. Laws of logic: Idempotent laws, Commutative laws, • Associative laws, Distributive laws, Complement laws, De Morgan's Law.	
Unit II	**Set Theory**	**8**
	• Introduction, definition of set, subset. • Methods of describing of a set: Tabular form, Set builder Form, Cardinality of set. • Types of set: Finite set, Infinite set, Empty set, Universal set, Equal sets, Disjoint sets, complementary set. • Operation on Sets: Union of sets, Intersection of sets, Difference of sets. • De Morgan's Laws. • Cartesian product of two sets. • Properties of set operations: Commutative law, Associative law, Distributive law.	
Unit III	**Functions and Relation**	**7**
	• Introduction of function, Domain, Codomain, Range of Function, Operation on function • Definition of Relation, Reflexive relation, Symmetric relation, • Transitive relation, Inverse Relation, Equivalence Relation, Identity Relation	
Unit IV	**Divisibility of integers**	**7**
	• Introduction, Divisibility Definition and Properties. • Division algorithm. • Greatest common Divisor (GCD). • Least common multiple (LCM), Prime number. • Euclidean algorithm. • Fundamental thermos of Arithmetic (Statement)Twitter Tools and tips for mangers • Instagram & Snapchat basics.	

Course Outcomes: Student should be able to …

1. Apply logic when creating systems.
2. Demonstrate mathematical skills, analytical and critical thinking abilities.
3. Analyze the types of relations and function.

REFERENCE BOOKS:

1. Gene H. Golub, Charles F. Van Loan, *Matrix Computations*, Johns Hopkins University Press, 4th Edition, 2013.
2. John H. Mathews, Kurtis D. Fink, *Numerical Methods Using MATLAB*, Pearson, 4th Edition, 2004.
3. Richard L. Burden, J. Douglas Faires, *Numerical Analysis*, Cengage Learning, 10th Edition, 2015.
4. Gilbert Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 5th Edition, 2016.
5. Steven C. Chapra, Raymond P. Canale, *Numerical Methods for Engineers*, McGraw-Hill Education, 7th Edition, 2015.
6. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson, 1st Edition, 2006.
7. Michael T. Heath, *Scientific Computing: An Introductory Survey*, McGraw-Hill, 2nd Edition, 2002.

BCAT118: Computational Statistics I

Course Objectives: Student will be able to …

1. Understand the basic concepts of statistics.
2. Perform the frequency distribution and data presentation.
3. Compute various measures of central tendency, dispersion.
4. Analyze the data and interpret the results.

SYLLABUS: **Credit: 02**

No of Credits: 2	**SEMESTER-I** **BCAT 118: Computational Statistics I** **Theory: 36 Lectures (30 Hours)**	**No of Hours (30)**
Unit I	**Introduction of Statistics, Data Condensation and Presentation**	**8**
	1.1 Introduction of statistics, Definition, Importance, Scope and limitations of statistics. 1.2 Data Condensation: Primary data, Secondary data, Qualitative &Quantitative data, variables, Scales of measurements: Nominal, Ordinal, Interval &Ratio. Collection and Summarization of univariate data and frequency distribution. 1.3 Data Presentation: Diagrammatic & graphical presentation of data, Piediagram, line diagram. Simple, multiple & partial bar diagram, histogram, ogive curves.	
Unit II	**Descriptive Statistics**	**8**
	2.1 Measure of Central tendency: Concept of Central tendency, Criteria for goodmeasures of central tendency, Types: Arithmetic mean (A.M.), Geometric Mean (G.M.), Harmonic Mean (H.M.), Relation between them and their properties (without proof). Median,Mode,Partition values. 2.2 Measure of dispersion: Concept of measures of dispersion, absolute and relative measures of dispersion, Range, Quartile Deviation (Q.D.), Mean Deviation (M.D.), Standard deviation (S.D.), Variance, Coefficient of Variation, with their properties (without proof). • Numerical problems.	
Unit III	**Probability**	**8**
	1 Concepts of experiments and random experiments. 3.2 Definitions: Sample space, Discrete sample space. 3.3 Event, Types of events: Elementaryevent, Compound event, favorable event, mutually exclusive events, Exhaustive events, Impossible events, certain event. Power set. 3.4 Illustrative examples. 3.5 Apriori definition of probability. Axiomatic definition of Probability with reference to a finite and countably infinite sample Space. Results: i) $P(\Phi) = 0$, $P(A^c) = 1 - P(A)$,	

	ii) P(AUB)=P(A)+P(B)- P(A∩B) (without proof)	
Unit IV	**Conditional Probability and Independence of events**	**6**
	4.1 Definition of conditional Probability of an event. 4.2 Multiplication Theorem for two events. 4.3 Statement and proof of Baye's Theorem and Example. 4.4 Concept of Independence of two event. 4.5 Examples.	

Course Outcomes: Student should be able to …

1. Create and interpret frequency tables.
2. Display data graphically and interpret graphs.
3. Recognize, describe, and calculate the measures of central tendency and dispersion.
4. Compute examples on sample space, simple examples on probability.

REFERENCES BOOKS:

1. Wiley, J. W., & Hogg, R. V., *Introduction to Mathematical Statistics*, Pearson, 7th Edition, 2019.
2. David C. Smith, David A. Harville, *Computational Statistics*, Springer, 1st Edition, 2010.
3. Peter Hall, *Advanced Data Analysis from an Elementary Point of View*, Cambridge University Press, 1st Edition, 2015.
4. Geof H. Givens, Jennifer A. Hoeting, *Computational Statistics*, Wiley, 1st Edition, 2005.
5. Julian J. Faraway, *Practical Regression and Anova using R*, CRC Press, 1st Edition, 2016.
6. Christian Heumann, Michael Schomaker, Shalabh, *Statistics Explained*, 2nd Edition, 2016.
7. V. S. K. L. R. V. Rao, S. G. Seetharam, *Computational Statistics: A Practical Approach*, Springer, 1st Edition, 2013.

LAB-I: BCAP 119 : Based on BCAT 117 and BCAT 118

Computational Mathematics–I and Computational Statistics - I

Course Objectives: Students will be able to….

1. Understand the basic of logic.
2. Understand the basic set theory.
3. Understand the basic of Divisibility of integers.
4. Understand the basic concepts of statistics.

Credits (Total Credits 2)	SEMESTER - I LAB COURSE – I : BCAP 11 Computational Mathematics–I + Computational Statistics - I	No. of hours 60 Hrs.
	Computational Mathematics–I	
1	Problems on Logical operation.	**2**
2	Laws of logic with an example.	**2**
3	Examples on Tautology, Contradiction, and Contingency.	**2**
4	De Morgan's law with an example.	**2**
5	Cartesian product of set and Difference of set with an example.	**2**
6	Example of Functions and Relation.	**2**
7	Greatest common divisor and Least common Multiplier with an example.	**2**
8	Examples of Operations and function.	**2**
9	Examples of Division algorithm.	**2**
10	Euclidian algorithm with an example.	**2**
	Computational Statistics - I	
11	Construction of Discrete Frequency Distribution	**2**
12	Construction of Continuous Frequency Distribution	**2**
13	Graphical Representation I	**2**
14	Graphical Representation II	**2**
15	Measure of Central Tendency I (Individual data and Discrete frequency distribution)	**2**
16	Measure of Central Tendency II (Continuous frequency distribution)	**2**
17	Measure of Dispersion I (Individual data and Discrete frequency distribution)	**2**
18	Measure of Dispersion II (Continuous frequency distribution)	**2**
19	Probability I	**2**
20	Application of Probability and Conditional Probability	**2**

Course Outcome: Students should be able to….

1. Apply logic when creating systems.
2. Demonstrate mathematical skills, analytical and critical thinking abilities.
3. Analyze the types of relations and function.

4. Draw diagram and graphs based on frequency distribution.
5. Understand how to summarized data and find averages as well as spread of the data from central value.
6. Find the probabilities of events and conditional probabilities.

REFERENCES BOOKS:

1. John H. Mathews, Kurtis D. Fink, *Numerical Methods Using MATLAB*, Pearson, 4th Edition, 2004.
2. Steven C. Chapra, Raymond P. Canale, *Numerical Methods for Engineers*, McGraw-Hill Education, 7th Edition, 2015.
3. C. F. Van Loan, G. H. Golub, *Matrix Computations*, Johns Hopkins University Press, 4th Edition, 2013.
4. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson, 1st Edition, 2006.
5. G. Jay Kerns, *An Introduction to Programming with MATLAB: Basic Programming and Application*, Academic Press, 1st Edition, 2017.
6. Julian J. Faraway, *Practical Regression and Anova using R*, CRC Press, 1st Edition, 2016.
7. David C. Smith, David A. Harville, *Computational Statistics*, Springer, 1st Edition, 2010.

SEM-II

BCAT- 211 : Computer Programming – I (30)

Course Objectives: Student will be able to …

1. Understand algorithmic thinking and algorithm presentations
2. Learn Basic data types and control structures in C.
3. Studies of structured programming concepts.
4. Able to use standard library functions in C Language.

SYLLABUS: **Credit: 02**

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Introduction to programming**	**8**
	• Character set • Variables and Constants • Rules for naming the Variables/Identifiers • Basic data types of C Int, char, float, double • storage capacity – range of all the data types • Storage classes	
Unit II	**Control Structure**	**6**
	• Operators and Expressions • Precedence of Operators, • Simple I/O statements • Control structures – if, if else, switch- case, for, while, do-while, break, continue.	
Unit III	**Arrays**	**6**
	• Arrays • Declaration, initialization and processing • Defining simple arrays • Multi-dimensional arrays • Strings: Strings Manipulation • Arrays of Strings.	
Unit IV	**Function**	**10**
	• Functions: Definition • Return values & their types • function call, recursion • passing Arrays to Functions • String functions (strcpy(), strcmp(), strcat(), strlen(), strrev()).	

Course Outcomes: Student should be able to …

1. Uses Variables and Constants.
2. Use Basic data types of C.
3. Do concept of modular programming.
4. Work with Array & its types

REFERENCES BOOKS:

1. Kernighan, B. W., & Ritchie, D. M., *The C Programming Language*, Prentice Hall, 2nd Edition, 1988.
2. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw-Hill, 7th Edition, 2019.
3. John R. Hubbard, *Programming in C*, Schaum's Outline Series, 2nd Edition, 2000.
4. D. S. Malik, *C Programming: Program Design Including Data Structures*, Cengage Learning, 5th Edition, 2015.
5. Brian W. Kernighan, Rob Pike, *The Practice of Programming*, Addison-Wesley, 1st Edition, 1999.
6. Paul Deitel, Harvey Deitel, *C: How to Program*, Pearson, 8th Edition, 2015.
7. David I. Schneider, *Fundamentals of Programming in C*, Jones & Bartlett Learning, 1st Edition, 2012.

BCAT – 212: Database Management System

Course Objectives: Student will be able to …

1. Learn fundamental concepts of data.
2. Describe the basic concepts of DBMS and various databases used in real applications
3. Learn the principles behind systematic database design approaches.
4. Study the database structure by applying the concepts of Entity relational model and Normalization.

SYLLABUS: **Credit: 02**

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Introduction to Database Management Systems**	**10**
	• Definition of Database • Characteristics of database • Data models • Importance of datamodels • ER Model • Relational Model • Network Model • Hierarchical Model • Object Oriented Model • Concept of DBMS • DBMS architecture and data independence.	
Unit II	**Entity Relationship Modeling and Relational Data Model**	**8**
	• Entities • Attributes and Entity Sets • Relation and Relationships sets • Features of E-R Model • Relational Model - Basic concepts, • Types of constraints(relational constraints) • DFD and its Types • ERD and types of relationship	
Unit III	**Basics of Structured Query Language**	**6**
	• Basic SQL Queries • DDL (Create, Alter, Drop) Commands • DML (Insert, Update, Delete) Commands • Select Statement • Constraints(Primary Key, Foreign Key, Unique Key, Null ,Check, Default, Super Key, Candidate Key) • Datatypes , • Operators • Functions.	
Unit IV	**Organization of Database System**	**6**
	• Introduction of file • File types • Organization of file- heap file organization • Serial file organization	

	• Sequential • Index sequential file • Random access file (direct access file) • Types of Database System • Centralized database system • Client-server system • Distributed database system	

Course Outcomes: Student should be able to …

1. Demonstrate basics of different database models for software development.
2. Identify the basic concepts and various data model used in database design
3. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.
4. Identify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.

REFERENCES BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson, 7th Edition, 2016.
2. Abraham Silberschatz, Henry Korth, S. Sudarshan, *Database System Concepts*, McGraw-Hill Education, 6th Edition, 2010.
3. C. J. Date, *An Introduction to Database Systems*, Addison-Wesley, 8th Edition, 2003.
4. Peter Rob, Carlos Coronel, *Database Systems: Design, Implementation, & Management*, Cengage Learning, 13th Edition, 2018.
5. Michael J. Hernandez, *Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design*, Addison-Wesley, 3rd Edition, 2013.
6. Thomas Connolly, Carolyn Begg, *Database Systems: A Practical Approach to Design, Implementation, and Management*, Pearson, 6th Edition, 2015.
7. Elmasri, R., & Navathe, S. B., *Fundamentals of Database Systems*, Pearson, 7th Edition, 2016.
8. J. D. Ullman, Jennifer Widom, *A First Course in Database Systems*, Pearson, 3rd Edition, 2010.

LAB-III: BCAP 213 : Based on BCAT 211 and BCAT 212

Computer Programming – I and Database Management System

Course Objectives: Students will be able to….

1. Learn Basic Programming Concepts
2. Study different basic concepts arrays in C
3. Understand the different concepts of operations on Pointers.
4. Learn the DDL and DML Query.

Credits (Total Credits 2)	SEMESTER - II LAB COURSE – I : BCAP 213 Computer Programming – I + Database Management System	No. of hours 60 Hrs.
	Computer Programming – I	
1	Write a C program to display "This is my first C Program".	**2**
2	Write a C program to find if a given no. is prime or not	**2**
3	Write a C program to compute Fibonacci series	**2**
4	Write a C program to insert an element in one dimensional array at a given position	**2**
5	Write a C program to delete an element from one dimensional array.	**2**
6	Write a C program to multiply a 3*3 matrix.	**2**
7	Write a C program to check if given string is palindrome or not.	**2**
8	Write a C program using function to find sum of two numbers with no argument & no return value	**2**
9	Write a C program to perform addition, subtraction, division and multiplication of two numbers.	**2**
10	Write a C program to reverse the entered string from command line arguments.	**2**
11	Write a program to input two numbers and display the maximum number.	**2**
12	Write a C program to calculate area and circumference of a circle.	**2**
13	Write a C program to check prime and Armstrong number by making functions	**2**
14	Write a C program to find the sum of natural numbers using recursion	**2**
15	Write a C program to calculate the factorial of a number using recursion	**2**
	Database Management System	
1	In the Database file Add these Fields: (Total: Datatype- Number 3 digits, Percentage: Datatype – Number 3 digits with 2 decimal places, Grade: Datatype- Char with 2 letters)	**2**
2	Insert more 3 records in MARKSHEET using SQL mode	**2**
3	Update the values for newly added columns i.e. Total, Percentage, Grade table using UPDATE command. (Grades should be A1 to E2 as per CBSE exam pattern)	**2**
4	Display all records of the marksheet table, write SQL command	**2**
5	Display name, rollno, marks of 3 subjects, total and percentage using design view.	**2**
6	Write SQL command to display name, rollno, grades from the marksheet table.	**2**
7	Display the maximum and minimum marks for Sub101 using design	**2**
8	Display the sum of marks for Sub102 using SQL command.	**2**
9	Display the rollno, student name and percentage whose name starts with A using SQL command.	**2**
10	Display the rollno, student name and percentage whose name second letter is 'I' using SQL command.	**2**

11	Display all the records from the marksheet table whose name ends with 'N' using SQL command.	**2**
12	Display the rollno, name and percentage whose percentage are more than 70.	**2**
13	Display the records who secured the grade A1 and A2.	**2**
14	Display all the record in ascending order of names using SQL view.	**2**
15	Delete the records from table who is failed in any of the subject. (You can use any mode)	**2**

Course Outcome: Students should be able to….

1. Develop skills for writing programs using 'C'.
2. Develop a Programming logic.
3. Exhibit critical and creative thinking skills for analysis and evaluation of problems.
4. Create database and used SQL command.

REFERENCES BOOKS:

1. B. W. Kernighan, D. M. Ritchie, *The C Programming Language*, Prentice Hall, 2nd Edition, 1988.
2. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw-Hill, 7th Edition, 2019.
3. Paul Deitel, Harvey Deitel, *C: How to Program*, Pearson, 8th Edition, 2015.
4. John R. Hubbard, *Programming in C*, Schaum's Outline Series, 2nd Edition, 2000.
5. David I. Schneider, *Fundamentals of Programming in C*, Jones & Bartlett Learning, 1st Edition, 2012.
6. Peter Rob, Carlos Coronel, *Database Systems: Design, Implementation, & Management*, Cengage Learning, 13th Edition, 2018.
7. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson, 7th Edition, 2016.
8. Michael J. Hernandez, *Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design*, Addison-Wesley, 3rd Edition, 2013.
9. Thomas Connolly, Carolyn Begg, *Database Systems: A Practical Approach to Design, Implementation, and Management*, Pearson, 6th Edition, 2015.
10. Elmasri, R., & Navathe, S. B., *Fundamentals of Database Systems*, Pearson, 7th Edition, 2016.

Minor Paper SEM-II

BCAT-124: Integrated Circuits for Computational Application

Course Objectives: Student will be able to …

1. To familiarize students with Integrated circuit such as IC 555
2. To teach students basic principles of Operational amplifier.
3. To introduce students to digital logic integrated circuits.
4. To explain the digital logic families.

SYLLABUS: **Credit: 02**

No of Credits: 2	Integrated Circuits for Computational Application	No. of Hours (30)
Unit I	**IC 555**	**6**
	• Introduction • Block diagram • Astable multivibrator using IC 555 • Bistable multivibrator using IC 555 • Application of Multivibrator	
Unit II	**Operational Amplifier**	**8**
	• Introduction, • Pin Diagram of Op-Amp • Characteristics of ideal Op-Amp • Classifications of Op-Amp • Applications	
Unit III	**74XX-series of digital logic integrated circuits**	**8**
	• Introduction • List • Pin diagrams with its function • Significance • Applications	
Unit IV	**Digital Logic Families**	**8**
	• Introduction, • Classification • Characteristics • Difference • Applications	

Course Outcomes: Student should be able to …

1. Students will be able to identify and explain the about timer Ic.
2. Students will be able to understand Basics of operational amplifier.
3. Students will understand digital logic integrated circuits with details.
4. Students will comprehend the digital logic families.

REFERENCES BOOKS:

1. David A. Johns, Ken Martin, *Analog Integrated Circuit Design*, Wiley, 1st Edition, 1997.

2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw-Hill, 1st Edition, 2001.

3. Richard G. Baranek, et al., *Integrated Circuit Design: A Complete Guide to CMOS Design*, Academic Press, 1st Edition, 2010.

4. John W. Davis, Robert G. Meyer, *Analog Integrated Circuit Design*, Springer, 1st Edition, 2002.

5. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, *Analysis and Design of Analog Integrated Circuits*, Wiley, 5th Edition, 2009.

6. Gregory J. Kulka, *Digital Integrated Circuit Design Using Verilog and SystemVerilog*, Springer, 1st Edition, 2010.

7. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits: A Design Perspective*, Pearson, 2nd Edition, 2003.

BCAT-125: Computational Digital Electronics-II

Course Objectives: Student should be able to …

1. To introduce students to the sequential Combinational circuits such as flip-flops.
2. To explore sequential circuits including shift registers with its types.
3. To enable students to design counter.
4. To explain about basics of computer organization.

No of Credits: 2	Topic	No of Hours (30)
Unit I	**Flip Flops**	**8**
	• Difference between combinational circuits and sequential circuits, • Concept of clock, • Introduction of flip flop, Types of flip flop, it's truth table, Application of flip flop	
Unit II	**Shift Resistors**	**8**
	• Introduction of Shift resistor • SISO, SIPO, PISO, PIPO • Ring counter, • Universal 4-bit shift register, • IC 7495 • Applications of counter	
Unit III	**Counter**	**6**
	• Introduction of Counter • Basic building block of counter, • Ripple counter, • up counter, down counter, UpDown counter, • Concept of modulus counters, • Decade counter, IC 7490 • Applications of counter	
Unit IV	**Computer Organization**	**8**
	• Memory • Introduction, classification, • Characteristics (RAM,ROM,DRAM,EPROM, Cache memory, FLASH memory) • Computer architecture • von Neuman architecture • parallel processing	

Course Outcomes: Student will be able to …

1. Students will be able to design, analyze, and optimize basic digital circuits using Boolean expressions and logic gates.
2. Students will verify truth table using digital designs on hardware platforms.
3. Students will understand the behavior of sequential circuits and their applications in digital systems such as Encoder, Decoder and multiplexer, de- multiplexer.
4. Students will be able to use software tools (e.g., FPGA design software, circuit simulation tools) to simulate and validate digital designs before implementation.

REFERENCES BOOKS:

1. M. Morris Mano, *Digital Design*, Pearson, 5th Edition, 2013.
2. John F. Wakerly, *Digital Design: Principles and Practices*, Pearson, 4th Edition, 2005.
3. Albert Paul Malvino, David J. Bates, *Digital Principles and Applications*, McGraw-Hill, 8th Edition, 2014.
4. R. P. Jain, *Modern Digital Electronics*, Tata McGraw-Hill, 4th Edition, 2010.
5. William H. Gothmann, *Digital Electronics: An Integrated Approach*, Prentice Hall, 3rd Edition, 2002.
6. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, McGraw-Hill, 5th Edition, 2011.
7. David A. Patterson, John L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, Morgan Kaufmann, 5th Edition, 2013.
8. William Stallings, *Computer Organization and Architecture: Designing for Performance*, Pearson, 10th Edition, 2015.

LAB-I: BCAP 126: Based on BCAT 124 and BCAT 125

Integrated Circuits for Computational Application + Computational Digital Electronics-II

Course Objectives: Students will be able to….

1. Understand Fundamentals of Electronics – hardware
2. Learn How to Design hardware.
3. Understand the basic of logic.
4. Study Digital electronics.

Credits (Total Credits 2)	SEMESTER - II LAB COURSE – I : BCAP 126 Integrated Circuits for Computational Application + Computational Digital Electronics-II	No. of hours 60 Hrs.
Integrated Circuits for Computational Application		
1	Study of Astable multivibrator using IC 555.	**2**
2	Study of Bistable multivibrator using IC 555.	**2**
3	Study IC 555 timer Application.	**2**
4	Study of Characteristics of ideal Op-Amp.	**2**
5	Study of Op-Amp as Inverting amplifier	**2**
6	Study of op-Amp as non-inverting amplifier.	**2**
7	Study of 74XX-series of digital logic integrated circuits.	**2**
8	Study IC 74XX Applications.	**2**
9	Study of TTL NAND gate.	**2**
10	Study TTL NOR gate.	**2**
Computational Digital Electronics-II		
1	Study of RS flip-flop.	**2**
2	Study of JK flip-flop.	
3	Study of ripple counter.	**2**
4	Study of up-down counter.	**2**

5	Study of SIPO shift register.	
6	Study of ripple counter.	**2**
7	Study of up-down counter.	**2**
8	Study of up-down counter.	**2**
9	Study of decade counter.	**2**
10	Study of Computer Architecture.	**2**

Course Outcome: Students should be able to….

1. Understand the timer IC application.
2. Develop the concept of Shift register.
3. Understand the different types of counter.
4. Understand the concept of computer architecture.
5. Develop and maintain problem- solving skills.

REFERENCES BOOKS:

1. David A. Johns, Ken Martin, *Analog Integrated Circuit Design*, Wiley, 1st Edition, 1997.
2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw-Hill, 1st Edition, 2001.
3. Richard G. Baranek, et al., *Integrated Circuit Design: A Complete Guide to CMOS Design*, Academic Press, 1st Edition, 2010.
4. John W. Davis, Robert G. Meyer, *Analog Integrated Circuit Design*, Springer, 1st Edition, 2002.

1. M. Morris Mano, *Digital Design*, Pearson, 5th Edition, 2013.
2. John F. Wakerly, *Digital Design: Principles and Practices*, Pearson, 4th Edition, 2005.
3. Albert Paul Malvino, David J. Bates, *Digital Principles and Applications*, McGraw-Hill, 8th Edition, 2014.
4. R. P. Jain, *Modern Digital Electronics*, Tata McGraw-Hill, 4th Edition, 2010.
5. William H. Gothmann, *Digital Electronics: An Integrated Approach*, Prentice Hall, 3rd Edition, 2002.

BCAT 127- : Computational Mathematics – II (30)

Course Objectives: Student will be able to …

1. Learn relationship between numbers.
2. Study different logical problems.
3. Understand relationship concept.

SYLLABUS: **Credit: 02**

No of Credits: 2	B.Sc. I (Computer Application) Sem II Computational Mathematics - II	No of Hours (30)
Unit I	**Matrix**	**6**
	• Definition of Matrix, Types of Matrices-Square Matrix, Row Matrix, Column, Zero Matrix, Diagonal Matrix, Scalar Matrix, Identity Matrix, Transpose of Matrix, Symmetric Matrix, Skew-symmetric Matrix, Examples. • Determinants: Definition and properties of Determinants of order 2^{nd} and 3^{rd} and their expansions, Minors and Cofactors, Examples. • Cramer's Rule singular and non-singular matrix, Examples. • Caley Hamilton Theorem (without proof).	
Unit II	**Algebra of Matrix and Inverse of Matrix**	**8**
	• Properties of matrix: Equality of Matrices, Scalar Multiplication of Matrix, Addition of Matrix, Subtraction of matrix, Multiplication of matrix, Invertible Matrix, Examples . • Rank of Matrix, Computation of inverse using definition, Examples. • Method of Inverse of matrix: Inversion Method, Elementary rows transformation, Elementary column transformation, Inverse of Matrix (Using Elementary Transformations), Examples.	
Unit III	**Graph and Operation on graphs**	**8**
	• Introduction, Components of Graph, Simple graph, Multigraph, Pseudo Graph, Definition and elementary Results. • Types of graphs: Complete, Regular, Bi-Partite, Complete Bi-partite. • Matrix Representation of Graph: Adjacency and Incidence Matrix, sub graphs and induced graph, complement of a graph. • Operation on Graph: Union of graph, Intersection of graph, Complement of graph.	
Unit IV	**Connected, Tree and Directed graph**	**8**
	• Definitions: Walk, Trail, Path and circuit, Dijkstra's shortest path • algorithm, Definition of Euler's and Hamilton Graph and Example, Tree • Definition. • Theorem: A tree with n vertices has n -1 edges.	

	• Theorem: A connected graph G with n vertices and n–1, edges is a tree. • Definition of Directed graph, Types of directed graphs. Ecommerce tracking • Actionable Insights & The Big Picture-Recap of Google Analytics reports and tools • Finding actionable insights • Getting the organization involved • Creating a data-driven culture • Resources Common mistakes analysts make Additional Web analytics tools.	

Course Outcomes: Student should be able to …

1. Understand different types of matrix and their types.
2. Find rank of Matrix for a Matrix.
3. Find matrix form of basic geometric transformations.
4. Draw Matrix Representation of Graph.

REFERENCES BOOKS:

1. G. D. Smith, *Numerical Methods for Engineers and Scientists*, Springer, 1st Edition, 2014.
2. C. T. Kelley, *Solving Nonlinear Equations with Newton's Method*, SIAM, 1st Edition, 2003.
3. R. L. Burden, J. D. Faires, *Numerical Analysis*, Cengage Learning, 10th Edition, 2015.
4. B. E. Guenther, J. W. Lee, *Partial Differential Equations of Mathematical Physics*, Springer, 1st Edition, 1996.
5. C. F. Van Loan, G. H. Golub, *Matrix Computations*, Johns Hopkins University Press, 4th Edition, 2013.
6. L. N. Trefethen, D. Bau, *Numerical Linear Algebra*, SIAM, 1st Edition, 1997.
7. J. W. Demmel, *Applied Numerical Linear Algebra*, SIAM, 1st Edition, 1997.
8. E. A. Bender, S. A. Orszag, *Advanced Mathematical Methods for Engineers: Asymptotic Methods and Perturbation Theory*, Springer, 1st Edition, 1999.

BCAT128: Computational Statistics II (30)

Course Objectives: Student will be able to …

1. Understand concepts of time series.
2. Introduce concept of correlation coefficient and how to interpret its value.
3. Understand concept of simple linear regression and multiple linear regression.
4. Analyze the data and interpret the results.

SYLLABUS: **Credit: 02**

No of Credits: 2	SEMESTER-II BCAT 128: Computational Statistics - II Theory: 36 Lectures (30 Hours)	No of Hours (30)
Unit I	**Time Series**	**8**
	• Meaning and need of time series analysis, • Components of times: Secular trend, Seasonal Variation, Cyclical variation, Irregular Variation. • Additive and Multiplicative model. • Utility of time series. • Measurement of trend: Moving averages method, Progressive average method, least square method, Measurement of seasonal indices by simple average method	
Unit II	**Correlation**	**8**
	• Concept of Bivariate data, covariance, • Correlation: Definition of correlation, Types of Correlation, Methods of Studying correlation. • Scatter diagram. • Karl Pearson's coefficient of correlation, Properties of correlation coefficient, interpretation of correlation coefficient, • Spearman's Rank Correlation coefficient (formula with & without ties).	
Unit III	**Regression (for ungrouped data)**	**8**
	• Concept of dependent and independent variables. Concept of regression, Lines of regression • Identification of response & predictor variables & relation between them. Difference between correlation and regression. • Fitting of line Y= a + bX. a and b are estimated using least Square method. • Regression Coefficients and their significance. Properties of Regression Coefficients. • Multiple regression: Concept of multiple regressions. Yule's Notations, Fitting of multiple regression planes. • Partial regression coefficients, interpretations.	
Unit IV	**Testing of Hypothesis**	**6**
	• Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic. • Hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, type I and type II errors, Critical region, level of	

	significance, p-value.one and two tailed test, power of test. • General procedure of testing of hypothesis..	

Course Outcomes: Student should be able to …

1. Understand fundamental concept of hypothesis testing.
2. Frame simple hypothesis and alternative hypothesis.
3. Measure the correlation between two variables and estimate the value.
4. Interpretation of multiple and partial correlation coefficient.

REFERENCES BOOKS:

1. G. Jay Kerns, *Introductory Statistics and Random Signals for Electrical Engineers*, Springer, 1st Edition, 2016.
2. Robert H. Shumway, David S. Stoffer, *Time Series Analysis and Its Applications: With R Examples*, Springer, 4th Edition, 2017.
3. Peter J. Bickel, Kjell A. Doksum, *Mathematical Statistics: Basic Ideas and Selected Topics*, 2nd Edition, 2006.
4. David Barber, *Bayesian Reasoning and Machine Learning*, Cambridge University Press, 2012.
5. Robert E. McCulloch, R. A. Neuhaus, *Bayesian Methods for Data Analysis*, Chapman and Hall/CRC, 3rd Edition, 2014.
6. W. N. Venables, B. D. Ripley, *Modern Applied Statistics with S-PLUS*, Springer, 4th Edition, 2002.
7. A. M. Dean, J. R. R. Thomas, *Statistical Methods for the Analysis of Experimental Data*, Springer, 1st Edition, 2014.
8. James E. Gentle, *Computational Statistics*, Springer, 2nd Edition, 2009.

LAB-I: BCAP 129 : Based on BCAT 127 and BCAT 128

Computational Mathematics–II and Computational Statistics - II

Course Objectives: Students will be able to….

1. Understand the basic of logic.
2. Understand the basic set theory.
3. Understand the basic of Divisibility of integers.
4. Understand the basic concepts of statistics.
5. Perform the frequency distribution and data presentation.
6. Compute various measures of central tendency, dispersion.
7. Analyze the data and interpret the results.

Credits (Total Credits 2)	SEMESTER – II LAB COURSE – I : BCAP 11 Computational Mathematics–II + Computational Statistics -II	No. of hours 60 Hrs.
	Computational Mathematics–II	
1	Symmetric and Skew-symmetric Matrix with an Example.	**2**
2	Examples on singular and non-singular matrix.	**2**
3	Examples of Crammer's Rule.	**2**
4	Examples on Elementary rows transformation.	**2**
5	Inverse of matrix using Elementary Transformation.	**2**
6	Examples of Rank of matrix.	**2**
7	Determinant of order 2^{nd} and 3^{rd} and their Expansion Examples.	**2**
8	Find the vertices: Even Vertices, odd vertices, number of edges in graph	**2**
9	Union of graph, Intersection of graph and degree of vertex with an example.	**2**
10	Dijkstra's shortest path algorithm with an example.	**2**
	Computational Statistics – II	
11	Time Series I (Moving Average Method)	**2**
12	Time Series II (Progressive Average Method)	**2**
13	Correlation I (Bivariate data)	**2**
14	Correlation II (Karl Pearson's Correlation coefficient)	**2**
15	Correlation III (Spearman's Rank Correlation coefficient)	**2**
16	Regression I (ungrouped data)	**2**
17	Regression II (Grouped data)	**2**
18	Testing of hypothesis I (Type I error, Type II error)	**2**
19	Testing of hypothesis (Power of test)	**2**
20	Case Study	**2**

Course Outcome: Students should be able to….

1. Understand different types of matrix and their types.
2. Find rank of Matrix for a Matrix.
3. Find matrix form of basic geometric transformations.
4. Draw Matrix Representation of Graph.
5. Sketch time series plots using MS-EXCEL.
6. Compute the different vital statistics.
7. Fit different discrete distribution on real life data.
8. Understand the concept of Testing of hypothesis.

REFERENCES BOOKS:

1. G. D. Smith, *Numerical Methods for Engineers and Scientists*, Springer, 1st Edition, 2014.
2. C. T. Kelley, *Solving Nonlinear Equations with Newton's Method*, SIAM, 1st Edition, 2003.
3. R. L. Burden, J. D. Faires, *Numerical Analysis*, Cengage Learning, 10th Edition, 2015.
4. B. E. Guenther, J. W. Lee, *Partial Differential Equations of Mathematical Physics*, Springer, 1st Edition, 1996.
5. G. Jay Kerns, *Introductory Statistics and Random Signals for Electrical Engineers*, Springer, 1st Edition, 2016.
6. Robert H. Shumway, David S. Stoffer, *Time Series Analysis and Its Applications: With R Examples*, Springer, 4th Edition, 2017.
7. Peter J. Bickel, Kjell A. Doksum, *Mathematical Statistics: Basic Ideas and Selected Topics*, 2nd Edition, 2006.