SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

(**Credit Framework and Structure of Four Year UG Program with Multiple Entry and Exit Option as per NEP-2020**)

UNDERGRADUATE PROGRAM OF

SCIENCE & TECHNOLOGY UNDER THE BOS OF COMPUTER SCIENCE AND APPLICATION

BCA (Single Major)

(Bachelor in Computer Application)

(Honours and Honours with Research)

Under the Faculty of Science & Technology

(Revised as per the Govt. Of Maharashtra circular Dt. 13-03-2024)

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(Based on the AICTE model curriculum suggested in Sept 2024)

From the Desk of the Dean, Faculty of Science and Technology

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power***", is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve ***the 3Es, the equity, the efficiency*** and ***the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employ ability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the

students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum. All the recommendations of the Sukanu Samiti given in the NEP Curriculum Framework-2023 have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students.

We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employ ability. Introduction of the mandatory On Job Training, Internship program for science background students is praise worthy and certainly help the students to imbibe first hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. M. K. Patil

Dean

Faculty of Science and Technology

Program Specific Outcomes:

PSO 01: Students will be able to understand analyses and develop computer programs in the areas related to algorithm, system software, web design and networking for efficient design of computer-based system.

PSO 02: Apply standard software engineering practices and strategies in software project development using open-source programming environment to deliver a quality of product for business success.

PSO 03: Student will be able to know various issues, latest trends in technology development in the field of AI and thereby, innovate new ideas and solutions to existing problems.

PSO 04: Explore technical knowledge in diverse areas of computer applications and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hrs. Practical (P) per week	1 Credit

B. Course Code and definition:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
DSC (CT/CP)	Core Courses
AEC	Ability Enhancement Courses
MDE	Multi-Disciplinary Elective course
VEC	Value added Courses
SEC (ST/SP)	Skill Enhancement courses
DSE (ET/EP)	Discipline Specific Elective
GE/OE	Open Elective
OJT	On Job Training (Internship/ Apprenticeship)
FP	Field Project
CEP	Community Engagement and Service
CC	Co-Curricular Courses
RM	Research Methodology
RP	Research Project /Dissertation

Course Level/Duration/System:

A. Eligibility for Admission: As per the regulations of the SRTMUN, AICTE/DTE and Government of Maharashtra, issued from Time-to-time regarding admission process.

B. As per NEP-2020 policy, it is a UG program (3/4 years) (6/ 8 Semesters) with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

1. One year: Under Graduate Certificate in Computer Application
2. Two years: Under Graduate Diploma in Computer Application
3. Three years: Bachelor in Computer Application (BCA)
4. Four years: Bachelor in Computer Application with Honours: BCA (Honours) or Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

Note: The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

SEMESTER WISE CREDIT DISTRIBUTION: Semester wise credit distribution of proposed BCA [BCA (Honours) and BCA (Honours with research)] program:

Semester	Core Courses	Ability Enhancement Courses (AEC)	Multi-Disciplinary Elective Course (MDE)	Value Added Courses (VEC)	Skill Enhancement courses (SEC)	Discipline Specific Elective (DSE)	Total
I	8	2	2	2	5	-	19
II	12	-	-	2	7	-	21
Higher Semester -Tentative Structure yet to be defined**							
III	-	-	-	-	-	-	19/20
IV	-	-	-	-	-	-	20/21
V	-	-	-	-	-	-	19/20
VI	-	-	-	-	-	-	20/21
BCA (Honours) Tentative Structure yet to be defined**							
VII	-	-	-	-	-	-	19/20
VIII	-	-	-	-	-	-	20/21
BCA (Honours with Research) Tentative Structure yet to be defined**							
VII	-	-	-	-	-	-	19/20
VIII	-	-	-	-	-	-	20/21

Category-wise distribution to be followed as per AICTE norms. **

Description	Core Courses (DSC)	Ability Enhancement Courses (AEC)	Multi-Disciplinary Elective course (MDE)	Value Added Courses (VEC)	Skill Enhancement Courses (SEC)	Discipline Specific Elective (DSE)	Total Credits
BCA	50	3	2	6	28	31	120
BCA (Honours)	55	3	5	6	40	51	160
BCA (Honours with Research)	82	3	2	6	28	39	160

Note:

**** For BCA at SRTMUN, yet to be defined / will be finalised after complete detailing of 3 years or 4 years BCA as and when approved by BoS / Academic Council/ University norms.**

Choice will be given for Students to take extra credit course from their own institute/college/ department or from other institute/college/ department as per the Admitting Body / University norms.

Examination: It will be held twice a year as per the policy of the university, usually as mentioned below.

Sr. No.	Name of the Examination	Main Examination	Supplementary Examination
1	BCA –Semester I, III, V, VII (For Honours and Research)	Winter	Summer
2	BCA –Semester II, IV, VI, VIII (For Honours and Research)	Summer	Winter

The examination specified in the preceding paragraph shall be held semester-wise at such places and on such dates as prescribed by the University.

Mapping of Marks to Grades: The mapping of marks to grades may be done as per the policy and norms of the university, enacted time to time. The AICTE Model syllabus has recommended following table.

Range of Marks	Assigned Grade
91-100	A^+
81-90	A
71-80	B^+
61-70	B
51-60	C^+
46-50	C
40-45	D
< 40	F (Fail due to less marks)
-	F^R (Fail due to shortage of attendance and therefore, to repeat the course)

Eligibility Criteria for Higher Semester Examinations:

1) The university rules shall be followed when admitting students into the next higher semester for BCA. However the AICTE Model syllabus has recommended following table

Sr. No.	Semester	ATKT/Promotion Rules
1	I	----------
2	II	Students enrolled in **Semester I** shall be allowed to keep the term for **Semester II**, provided they have appeared for at least one paper in the University Examination of Semester I.
3	III	The candidate must pass at least 40% of the total subjects (i.e., 6 papers out of 15, including Practicals) from both **Semester I** and **Semester II** combined.
4	IV	A student enrolled in **Semester III** shall be allowed to keep the term for **Semester IV**, provided they have appeared for at least one paper in the University Examination of Semester III.
5	V	The candidate must have cleared all papers from the first year (i.e., all papers from Semester I and Semester II, including Practicals) and must pass at least 40% of the total subjects (i.e., 5 papers out of 12, including Practicals) from both **Semester III** and **Semester IV** combined.

2) To be eligible for admission to the BCA (Honours) or BCA (Honours with Research) program, a student must have successfully completed a 3-year BCA program.

Language of Examination: The medium of instruction and examination will be English unless otherwise specified in the syllabus, except for Indian or foreign languages selected by students in the AEC course.

INDUCTION PROGRAM

Induction Program aimed at instilling core values and ethics in students, setting a precedent for a holistic educational journey that mirrors global standards. The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal. Please follow the Guide for Induction Program as suggested in AICTE Model Syllabus. The link for the reference is as given below,

https://www.aicte-india.org/sites/default/files/Model_Curriculum/BCA%20FINAL(2%20year%20).pdf on Page no. 131, Refer Appendix III)

Induction Program (Mandatory)	**Three-Week Duration**
Induction program for students to be offered right at the start of the first year.	• Physical Activity • **Creative Arts**: Painting, Sculpture, Pottery, Music, Dance etc. • **Universal Human Values**: Ethics, Rules and Regulation. • **Literary**: Debate, Critical Conversation, Analytical Exchange, Reasoned Discourse, etc. • **Proficiency Modules**: o English Spoken Classes o Basic of Information and Communication Technology o Basic of Internet, Google Drive o Computer Security & Cyber Crime Law etc. • **Lectures by Eminent People**: People who are socially active or in public life. • **Visits to Local Areas**: Landmarks of the city, or a hospital or orphanage could be organized. • **Familiarization to Department/Branch & Innovations**: Discuss the available facilities, types of events organized, programs, Avishkar, and ongoing research activities.

Mandatory Visits / Workshop/ Expert Lectures:

- It is mandatory to arrange one industrial visit every semester for the students.
- It is mandatory to conduct a One-week workshop during the winter break after fifth semester on Professional/ Industry/ Entrepreneurial orientation.
- It is mandatory to organize at least one expert lecture per semester by inviting resource persons from domain specific industry.

Semester wise Structure and Curriculum for UG Course in BCA

Semester -I

S. No.	Course Code	Course Title	L	T	P	Credit	% of Assessment			
							UA	CA	Total	Minimum passing %
3 WEEKS COMPULSORY INDUCTION PROGRAM (As mentioned in the AICTE guidelines)										
1	SBCACT1101	Mathematics Foundations to Computer Science -I	3	0	0	3	60	15	75	40%
2	SBCACT1102	Computer Architecture	3	0	0	3	60	15	75	40%
3	SBCACP1101	Lab-1 Computer Architecture	0	0	4	2	30	20	50	40%
4	SBCAST1101	Problem Solving Techniques	3	0	0	3	60	15	75	40%
5	SBCASP1101	Lab-1 Problem Solving Techniques	0	0	4	2	30	20	50	40%
6	SBCAE1101	General English – I OR suggested MOOC courses	1	1	0	2	40	10	50	40%
7	SBCAMD1101	Indian Knowledge System (as per the SRTMUN common syllabus for all faculties)	2	0	0	2	-	50	50	40%
8	SBCAVA1101	Environmental Science and Sustainability	2	0	0	2	-	50	50	40%
9	SBCAAE1102	Additional Course – Indian or Foreign Language Other than Mother Tongue and English ((1-1-0) [Optional C ourse] as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Indian / Foreign language) choose any one *	1	1	0	0*	-	25	25	40%
Total			**15**	**2**	**8**	**19**	**280**	**220**	**500**	

Note: For University Assessment (UA), College Assessment (CA) Evaluation Rules, Practical Assessment and for Question Paper Pattern refer to policy of the university

Note:

*** Indian Languages:** as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Sanskrit/Hindi/All Regional languages. The Foreign Languages: depending upon offering by the SRTM University and as per the SRTMUN common syllabus for all faculties mentioned as AEC courses like Spanish/German/French/Korean/Mandarin etc. The credits and credit pattern is as per SRTMUN norms

Semester-II

S. No.	Course Code	Course Title	L	T	P	Credit	% of Assessment			
							UA	CA	Total	Minimum passing %
1	SBCACT1151	Mathematics Foundations to Computer Science -II	3	0	0	3	60	15	75	40%
2	SBCACT1152	Data Structures	3	0	0	3	60	15	75	40%
3	SBCACT1153	Operating Systems	3	0	0	3	60	15	75	40%
4	SBCACP1151	Lab-2 Data Structures	0	0	4	2	30	20	50	40%
5	SBCACP1152	Lab-3 Operating System	0	0	2	1	15	10	25	40%
6	SBCAST1151	Object Oriented Programming using Java	3	0	0	3	60	15	75	40%
7	SBCASP1151	Lab-2 Object Oriented Programming using Java	0	0	4	2	30	20	50	40%
9	SBCASP1152	Lab-3 Web Technologies	0	0	4	2	30	20	50	40%
10	SBCAVA1151	Constitution of India (as per the SRTMUN common syllabus (VEC course) for all faculties)	2	0	0	2	-	50	50	40%
11	SBCAE1151	Additional Course – Indian or Foreign Language Other than Mother Tongue and English ((1-1-0) [Optional Course] as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Indian / Foreign languages(Choose any one))*	1	1	0	0*	-	25	25	40%
Total			**16**	**1**	**12**	**21**	**345**	**205**	**550**	

Note: For University Assessment (UA), College Assessment (CA) Evaluation Rules, Practical Assessment and for Question Paper Pattern refer to policy of the university

Note:

*** Indian Languages:** as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Sanskrit/Hindi/All Regional languages. The Foreign Languages: depending upon offering by the SRTM University and as per the SRTMUN common syllabus for all faculties mentioned as AEC courses like Spanish/German/French/Korean/Mandarin etc. The credits and credit pattern is as per SRTMUN norms

After Year 1, Students are advised to take Social Responsibility & Community Engagement - encompassing Community Engagement with an NGO in the vacation time.

An UNDER GRADUATE CERTIFICATE IN COMPUTER APPLICATION will be awarded, if a student wishes to exit at the end of First year. Exit Criteria after First Year of BCA Programme

Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the first year. Upon exit, they will be awarded a **UG Certificate in Computer Application**.

To be eligible for this certificate, students must complete an additional 04 credits in one of the following areas:

- **Skill-Based Subject**: A course designed to enhance practical and technical skills in the field of computer applications.
- **Work-Based Vocational Course**: A vocational course offered during the summer term that emphasizes hands-on training and workplace readiness.
- **Internship/Apprenticeship**: A professional internship or apprenticeship program in a relevant field, with a minimum duration of 08 weeks, which will take place after the second semester.
- **Social Responsibility & Community Engagement**: Active engagement with an NGO or community organization for a minimum duration of 08 weeks, focusing on real-world problem-solving, social responsibility, and community service.

The mode and specifics of these additional credits can be earn as decided by college and students will be required to complete the 08-week program during the summer term following their second semester.

The exiting students will clear the subject / submit the Internship Report as per the University schedule.

Re-entry Criteria in to Second Year (Third Semester)

The student who takes an exit after one year with an award of certificate may be allowed to re-enter in to Third Semester for completion of the BCA Program as per the respective College/University /Admitting Body schedule after earning requisite credits in the First year.

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Guidelines for the Course Assessment:

Continuous Assessment (CA) of theory and practical courses:

i. **For Theory Course:** CA shall form 15 marks and shall be carried out over the entire semester. It shall be done by conducting Two Tests (Test I on 40% curriculum) and Test II (on remaining syllabus) and average of the marks scored by a student in these two tests of a particular course /paper shall be taken as the CA score.
ii. **For Practical Course:** CA shall be for 20 marks and shall be the marks scored by a student in the internal practical examination conducted by the concerned teacher.
iii. **For AE, MD, VA, AE, etc. courses:** CA marks are same as displayed in the structure and are given as per the policy of the university or in absence of university guidelines, as decided by the concerned teacher/ institution.

End Semester Assessment (80% of the Maximum Marks) of theory and practical courses:

A. For illustration a course / paper of 03 credits / 60 marks has been considered. The Question Paper Pattern of the ESA:

Faculty of Science and Technology
BCA
Question paper format (As per NEP2020)

Time : 3 hrs ***Max. Marks: 60***

Instructions to the candidates:

1. *Question No. 1 is Compulsory.*
2. *From Q. No. 2 to 5 solve any three questions.*
3. *Figures to the right indicate full marks.*
4. *Assume suitable data, if necessary.*
5. *Use of any electronic media such as mobile phone, digital diary, and electronic calculator is not permitted.*

Q.1 Attempt the following (any three) **(15) Marks**
(Based on all units)

a)
b
c)
d)
e)

Q. 2 Attempt of the following (any three) **(15)**
(Based on unit 2)

a)
b)
c)
d)

Q. 3 Solve the following (any three) **(15)**
(Based on unit 2)

a)
b)
c)
d)

Q. 4 Attempt of the following (any three) **(15)**
(Based on unit 3)

a)
b)
c)
d)

Q. 5 Attempt of the following (any three) **(15)**
(Based on unit 4)

a)
b)
c)
d)

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B. For illustration a course / paper of 02 credits / 40 marks has been considered. The Question Paper Pattern of the ESA:

Faculty of Science and Technology
BCA
Question paper format (As per NEP-2020)

Instructions to the candidates:

6. *Question No. 1 is Compulsory.*
7. *From Q. No. 2 to 5 solve any three questions.*
8. *Figures to the right indicate full marks.*
9. *Assume suitable data, if necessary.*
10. *Use of any electronic media such as mobile phone, digital diary, and electronic calculator is not permitted.*

Q.1 Attempt the following (2 Marks each) (10)
(Based on all units/ Module)

a)
b
c)
d)
e)

Q. 2 Attempt of the following (any two) (5 Marks each) (10)
(based on unit/ Module 1)

a)
b)
c)

Q.3 Attempt of the following (any two) (5 Marks each) (10)
(based on unit/module 2)

a)
b)
c)

Q. 4 Attempt of the following (any two) (5 Marks each) (10)
(based on unit/Module 3)

a)
b)
c)

Q. 5 Attempt of the following (any two) (5 Marks each) (10)
(based on unit/ Module 4)

a)
b)
c)

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The syllabus for higher Years (Second/ Third / Fourth) will be displayed separately

Detailed Syllabus

SEMESTER –I

SEMESTER –I

Mathematics Foundation to Computer Science - I

SBCACT1101	Mathematics Foundation to Computer Science - I	3L:0T:0P	3 Credits

Course Objectives

CO1: Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.

CO2: This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.

CO3: This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.

Course Content:

UNIT I: **Set Theory**

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products.
Power sets, Partitions of set, Principle of inclusion and exclusion.

UNIT II**: Relation and Function**

Relations on a Set, Types of Relations, Properties of Relations, Equivalence Relation, Functions,
types of functions, composition of functions, inverse of functions. Some useful functions for
Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

UNIT III: **Matrix and Determinant**

Matrix, Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices,
determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations in two variables.

UNIT IV: **Graph Theory**

Graphs, Basic terminologies of graphs, types of graphs, connected and disconnected graphs, subgraph, Walks, paths and circuits, , digraphs, weighted graphs, Euler and Hamiltonian graphs,
Trees, properties of trees, spanning tree. Definitions and basic results on the topics mentioned.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Pub Co, 2024.
   (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Pub Co, 2023,
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education,2015

Web Resources

1. https://nptel.ac.in/courses/106103205
2. https://nptel.ac.in/courses/111101115

Computer Architecture

SBCACT1102	Computer Architecture	3L:0T:0P	3 Credits

Course Objectives

CO1: To Understand the basics of Digital Electronics and Binary Number System CO2: To Learn the implementation of Combinational Circuit.

CO3: To Learn the implementation of Sequential Circuit.

CO4: To Understand the Organization of basic computers.

CO5: To Understand the concept of Parallel Processing.

CO6: To understand the concept of memory organization.

Course Content:

UNIT-I

Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Logic Gates, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS.

Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Error detecting and correcting codes.

UNIT-II

Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer

Sequential Circuits: Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.

Register: 4 bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load

Binary Counters-4 bit synchronous and Asynchronous binary counter.

UNIT-III

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control,

UNIT-IV

Parallel Processing. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP).

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha- "Digital Principles & Applications" , Tata McGraw Hill Education Private Limited,2011Edition.
2. M. Morris Mano- "Computer System Architecture", Pearson/Phi, Third Edition.
3. Dr.S.B.Kishor Digital Electronics , Dasganu Prakashan Nagpur.

Reference Books:

1 William Stallings- "Computer Organization and Architecture", Pearson/PHI, Sixth Edition,

2 Andrew S. Tanenbaum- "Structured Computer Organization", PHI /Pearson 4th Edition,

3 M.V .Subramanyam, "Switching Theory and Logic Design", Laxmi Publications (P) Ltd.

SBCACP1101	Lab-1: Computer Architecture	0L:0T:4P	2 Credits

Note: Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

Suggestive Laboratory Experiments:

1. Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. To verify De- Morgan's theorem for 2 variables
4. Design and test of an S-R flip-flop using NAND/NOR gate.
5. Convert BCD to Excess-3 code using NAND gate
6. To Convert Binary to Grey Code
7. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1 MUX using gates.
10. Implementation of 4-Bit Parallel Adder Using 7483 IC.
11. Design and verify operation of half adder and full adder.
12. Design and verify operation of half subtractor.
13. Design and Implement a 4 bit shift register using Flip flops.
14. Implement Boolean function using logic gates in both SOP and POS
15. Design and Implement a 4 bit synchronous counter.
16. Design and verify 4 bit asynchronous counter.

Hardware

1. Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards.
2. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
3. Identify and Troubleshoot the problems of RAM, SMPS and motherboard
4. Configure BIOS settings- disable and enable USB and LAN 5. Adding additional RAM to the system.(expanding RAM size).
6. To Study mother board layout of a system.
7. Demonstrate the assembly of a PC
8. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse) ,USB, LAN, Speaker, Audio.
9. Install and configure windows OS
10. To study the installation of Printer and trouble shooting.

Problem Solving Techniques

SBCAST1101	Problem Solving Techniques	3L:0T:0P	3 Credits

Course Objectives

CO1: Understand basic terminology of computers, problem solving, programming Languages and their evolution (Understand)

CO2: Create specification from problem requirements by asking questions to disambiguate the requirement statement. (Create)

CO3: Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement). (Create)

CO4: Translate an algorithm into a C computer program (Create)

CO5: Testing and analysing programs using debugging tools. (Analyze)

Prerequisite: This is an introductory programming course and hence no prerequisites

Course Content:

UNIT I: (CO-1, CO-2)

Problems And Problem Instances, Generalization and Special Cases, Types of Computational Problems, Classification of Problems, Analysis of Problems, Solution Approaches, Algorithm Development, Analysis of Algorithm, Efficiency, Correctness, Role of Data Structures in Problem Solving, Problem-Solving Steps (Understand the Problem, Plan, Execute, And Review)

UNIT II: (CO-2, CO-3, CO-4)

C Language: Introduction To Programming Languages, Different Generations of Programming Languages. History of C Language, An Empty C Program. C Language Counterparts For Input (scanf()), Output (printf()) Statements.

Structured Programming Concepts: Sequence (Input/Output/Assignment), Selection (If, If-Else) And Repetition (For, While, Do-While) Statements, Control Structure Stacking and Nesting.

Different Kinds of Repetitions: Entry Controlled, Exit Controlled, Counter Controlled, Pseudocode and Flowcharts. Definition And Characteristics of Algorithms, Standard Algorithm Format. Problems Involving Iteration and Nesting: Displaying Different Patterns and Shapes Using Symbols and Numbers, Fibonacci and Other Sequences, ASCII, UNICODE.

UNIT III: (CO-2, CO-3, CO-4)

Assignment, Arithmetic, Relational and Logical Operators. If, If-Else Statements, For, While, Do-While Statements. Data Types. Translating Pseudocode/Algorithm to C Program. Incremental Compilation and Testing of The C Program. Simple Problems Involving Input, Output, Assignment Statement, Selection and Repetition. Good Coding Practices

Problems on Numbers: Extracting Digits of a Number (Left to Right and Right to Left), Palindrome, Prime Number, Prime Factors, Perfect Number, Armstrong Number, Factorial.

C Language: else-if Ladder, switch Case, Increment/Decrement Operators, break and continue Statements.

UNIT IV: (CO-2, CO-3, CO-4, CO-5)

Modular Programming, Top-Down and Bottom-Up Approaches to Problem Solving. Recursion. Problems on Arrays: One Dimensional and Two-Dimensional Arrays ,Reading and Writing of Array Elements, Maximum, Minimum, Sum, Average, Median and Mode.

C Language: Function Definition and Declaration (Prototype), Role of Return Statement. String Functions. Other Operators, Operator Precedence and Associativity. Debugging.

Introduction to Pointers

Text Books

1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
3. Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.
4. R G Dromey, How to Solve It by Computer.
5. Dr.S.B.Kishor, Programming Using C,Dasganu Prakashan,Nagpur.

Reference Books

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition, Pearson, 2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8th edition, Pearson, 2015.

SBCASP1101	Lab-1 :Problem Solving Techniques	0L:0T:4P	2 Credits

Note: Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

UNIT-II Practicals

1. Converting degrees Celsius to Fahrenheit and vice versa?
2. Display three input numbers in sorted (non-decreasing) order?
3. Given a positive integer value n (>= 0) display number, square and cube of numbers from 1 to n in a tabular format?
4. Given an input positive integer number, display odd numbers from in the range [1,n]?
5. Display first mathematical tables, each table up to 10 rows? Generalise this to display first n (> 0) mathematical tables up to m (m > 0) rows?
6. Display following patterns of n rows (n > 0), For the below examples n = 5? For each pattern write a separate algorithm/program?

$	$	12345	12345
$$	$$	1234	1234
$$$	$$$	123	123
$$$$	$$$$	12	12
$$$$$	$$$$$	1	1

7. Given the first term (a), difference/multiplier (d) and number of terms (n > 0), display the first n terms of the arithmetic/geometric progression?
8. Display the first n (n > 0) terms of the fibonacci sequence?
9. Display the first n (n > 0) terms of the Tribonacci sequence?
10. Given two positive integer numbers n1 and n2 check if the numbers are consecutive numbers of the fibonacci sequence?
11. Compute approximate value of π considering first n (n > 0) terms of theTaylor series for π?

12. Compute approximate value of ex considering first n (n > 0) terms of the Taylor series for ex?
13. Compute approximate value of sin(x)/cos(x) considering first n (n > 0) terms of the Taylor series for sin(x)/cos(x)?
14. Display the following patterns of n rows (n > 0), for the below examples n = 5?

Hollow square pattern:	Triangle Patterns with numbers:	Square with diagonals:	Diamond Pattern
##### # # # # # # #####	1 121 12321 1234321 123454321	* *	* *** ***** *** *

UNIT-III Practicals

1. Extract digits of an integer number (left to right and right to left)?
2. Given a sequence of digits form the number composed of the digits. Use sentinel controlled repetition to read the digits followed by -1. For example, for the input 2 7 3 2 9 -1 the output number is 27329?
3. Check if a given positive integer number is a palindrome or not?
4. Compute character grade from the marks ($0 \leq$ marks ≤ 100) of a subject. Grading Scheme: 80-100 : A, 60 - 79: B, 50 - 59: C, 40-49: D, 0-39: F? Solve this using both else-if ladder and switch case?
5. Compute the sum of a sequence of numbers entered using sentinel controlled repetition?
6. Check if a given positive integer number is a prime number or not?
7. Compute prime factors of a positive integer number?
8. Check if two positive integer numbers are amicable numbers or not?

9. Check if a given positive integer number is a perfect number or not?
10. Check if a given positive integer number Armstrong number or not?
11. Converting a positive integer number (n > 0) from one base (inputBase) to another base (outputBase) (2 <= input Base, outputBase <= 10). Input number should be validated before converting to make sure the number uses only digits allowed in the input base?
12. Write a program to display a number in text form. For example If the number is 5432 the output should be “FIVE FOUR THREE TWO”?
13. Using the grading scheme described in the question 4 (UNIT III), Compute how many students awarded each grade and display the frequency as a bar chart (horizontal) using single “*” for each student. Use sentinel controlled repetition (-1 as sentinel value) in reading the students marks. Use else-if ladder/switch case to compute the grade and the corresponding frequency.

    Sample bar chart when the class has 7-A, 10-B, 3-C, 7-D and 1-F grades.

    A: *******

    B:

    ****

    C: *** D:

    ****

    F: *
14. Compute maximum, minimum, sum and average of a sequence of numbers which are read using sentinel controlled repetition using only few variables?
15. Compute body mass index, BMI = weightinKGs / (HeightinMeters *HeightinMeters), Both weight and height values are positive real numbers. Your program should display BMI value followed by whether the person is Underweight, Normal, Overweight or Obese using the below ranges:

    BMI Values

    Underweight: less than 18.5

    Normal: >=18.5 and <25

    Overweight: >=25 and < 30

    Obese: >= 30

UNIT IV Practicals

1. Design a modularized algorithm/program to check if a given positive integer number is a circular prime or not?
2. Design a modularized algorithm/program to compute a maximum of 8 numbers?
3. Design a modular algorithm/program which reads an array of n integer elements and outputs mean (average), range (max-min) and mode (most frequent elements)?
4. Design a modular algorithm/program which reads an array of n integer elements and outputs median?
5. Implement your own string length and string reversal functions?
6. Design algorithm/program to perform matrix operations addition, subtraction and transpose?
7. Write a recursive program to count the number of digits of a positive integer number?
8. Recursive solutions for the following problems:
    a. Factorial of a number?
    b. Display digits of a number from left to right (and right to left)?
    c. Compute x^y using only multiplication?
    d. To print a sequence of numbers entered using sentinel controlled repetition in reverse order?

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General English – I

SBCAAE1101	**General English - I**	**1L:1T:0P**	**2 Credits**

Course Objective:

1. To provide learning environment to practice listening, speaking, reading and writing skills.
2. To assist the students to carry on the tasks and activities through guided instructions and materials.
3. To effectively integrate English language learning with employability skills and training.
4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

Course Content:

Unit- I: Phonology: Study of Speech Sounds

Sounds: Consonants (24), Sounds: Vowels (20), Three Term Label, Word Transcription

Unit-II: Morphology & Vocabulary Building

Open Word Classes, Closed word Classes, Noun Phrase, Verb Phrase, Adjective Phrase, Adverb Phrase, Prepositional Phrase, The concept of Word Formation, Root words, Acquaintance with prefixes and suffixes, standard abbreviations.

Unit- III: Syntax & Identifying Common Errors in Writing

Elements of Clause, Basic Clause types, Simple Sentence, Complex Sentence, Compound Sentence Subject-verb agreement, Common Errors in English

Unit-IV: Oral Communication (This Module involves interactive practice sessions in Language Lab)

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

Text/Reference Books:

1. AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007

5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011. 8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
8. Modern English Grammar, L. S. Deshpande, Creative Publication.
9. English for Practical Purposes, Z. N. Patil, Macmillan Publishers India Limited.

Alternative NPTEL/SWAYAM Course:

S.No.	NPTEL/SWAYAM Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha iqbal	IIT MADRAS
2	Technical English for engineers	Prof. Aysha iqbal	IITM

Course Outcomes: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

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Indian Knowledge System

SBCAMD1101	**Indian Knowledge System**	**2L:0T:0P**	**2 Credits**

IKS as per the SRTMUN common Syllabus for all faculties

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Environmental Science and Sustainability

SBCAVA1101	Environmental Science and Sustainability	**2L:0T:0P**	**2 Credits**

Course description:

This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. The course content is divided into four comprehensive units. Unit 1 introduces basic environmental principles, the man-environment relationship, and sustainability issues.

Unit 2 focuses on ecosystems, biodiversity, and sustainable practices.

Unit 3 addresses environmental pollution, waste management, and sustainable development strategies. Finally,

Unit 4 explores social issues, environmental legislation, and practical applications through hands-on fieldwork. Through this holistic approach, students will gain a deep understanding of environmental processes, the importance of sustainable practices, and their role in promoting sustainability within business contexts.

Course Objective(s):

1. This course aims to familiarize students with basic environmental concepts, their relevance to business operations, and forthcoming sustainability challenges.
2. This course will equip students to make decisions that consider environmental consequences.
3. This course will enable future business graduates to become environmentally sensitive and responsible managers.

Course Outcome(s):

1. Explore the basic environmental concepts and issues relevant to the business and management field.
2. Recognize the interdependence between environmental processes and socio-economic dynamics.
3. Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
4. Identify possible solutions to curb environmental problems caused by managerial actions.
5. Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

Course Content:

Unit 1: Understanding Environment, Natural Resources, and Sustainability

Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education.

Unit 2: Ecosystems, Biodiversity, and Sustainable Practices

Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management.

Unit 3: Environmental Pollution, E-Waste Management, and Sustainable Development

Various types of environmental pollution, including air, water, noise, soil, and marine pollution and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; E-waste and their management.

Unit 4: Social Issues

Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption.

Readings:

Text Books (Latest Editions):

- Poonia, M.P. *Environmental Studies* (3rd ed.), Khanna Book Publishing Co.
- Bharucha, E. *Textbook of Environmental Studies* (3rd ed.) Orient Blackswan Private Ltd.
- Dave, D., & Katewa, S. S. *Text Book of Environmental Studies.* Cengage Learning India Pvt Ltd.
- Rajagopalan, R. *Environmental studies: from crisis to cure* (4th ed.). Oxford University Press. ● Miller, G.T. & Spoolman S. *Living in the Environment*. (20th ed.). Cengage.
- Basu, M., & Xavier Savarimuthu, S. J. *Fundamentals of environmental studies*. Cambridge University Press.
- Roy, M. G. *Sustainable Development: Environment, Energy and Water Resources*. Ane Books.
- Pritwani, K. *Sustainability of business in the context of environmental management.* CRC Press.

- Wright, R.T. & Boorse, D.F. *Environmental Science: Toward A Sustainable Future* (13th ed,). Pearson.

References

Web links:

- https://www.ourplanet.com
- https://www.undp.org/content/undp/en/home/sustainable-development-goals.html ● www.myfootprint.org
- https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html

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Additional Course

SBCAAE1102	Additional Course – Indian or Foreign Language *	**2L:0T:0P**	**0 *Credits**

Additional Course – Indian or Foreign Language Other than Mother Tongue and English(1-1-0) [Optional Course] as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Indian / Foreign languages (Choose any one). Credit policy is as per the SRTMUN

SEMESTER –II

SEMESTER –II

Mathematics Foundation to Computer Science - II

SBCACT1151	**Mathematics Foundation to Computer Science - II**	**3L:0T:0P**	**3 Credits**

Course Objectives

CO1: This course helps the students to understand correct lines of arguments and proofs.

CO2: This course introduces mathematical techniques that are foundations for understanding advanced computational methods, including numerical methods and optimization.

CO3: This course helps the students to understand various problem-solving strategies and methods to tackle both theoretical and practical challenges in computer science.

Course Content:

UNIT I:

Mathematical Logic

Propositions, logical operations (connectives), compound statements, construction of truth table, conditional statements, tautology, contradiction, contingency, logical equivalence.

UNIT II:

Algebraic Structures:

Monoid , Semi-group, Group, Subgroup, Abelian group, Homomorphism, Automorphism and Isomorphism of groups.

UNIT III:

Numerical Methods:

Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods. Numerical Interpolation: Newton’s Forward and Newton’s Backward interpolation formula. Only formula and problem solving for all the topics mentioned above.

UNIT IV:

Optimization Techniques:

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method.

Text Books

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.

2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.

3. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.

4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.

2. Chakravorty J. G. and Ghosh P. R., Linear Programming and Game Theory, Moulik Library, 2017.

3. Sharma J. K., Operations Research: Theory and Applications, Fourth Edition, Macmilllan Publishers, 2007.

Web Resources

1. https://nptel.ac.in/courses/111107127

2. https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf

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Data Structures

SBCACT1152	Data Structures	3L:0T:0P	3 Credits

Course Objectives

CO1: Understand the fundamental concepts of Data Structures and their applications.

CO2: Develop problem-solving skills using Data Structures.

CO3: Implement Data Structures using C programming language.

Prerequisite:

1. **Programming Fundamentals:** Understanding the basic syntax and semantics of C programming language.
2. **Problem-Solving Skills:** Ability to break down a problem into smaller steps and devise a step-by-step solution and familiarity with simple algorithms.

Course Content:

UNIT I:

Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff.

Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two- Dimensional Arrays in Memory, Multi-Dimensional Arrays.

UNIT II:

Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists

UNIT III:

Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of

Postfix Expression.

Recursion: Definition, Recursive Notation, Run time Stack, Applications of Recursion: Factorial of Number,Fibonacci Series.

Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

UNIT IV:

Graphs: Definition, Terminology, Representation, Traversal.

Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree

Text Books

1. R.B. Patel, “Expert Data Structures with C”, Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, “Data Structures with C”, Schaum’s Outlines, Tata McGraw-Hill, 2011.
3. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.

Reference Books

1. Reema Thareja, “Data Structures Using C", Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

Web Resources

1. **GeeksforGeeks** - Data Structures Tutorial
2. **Khan Academy** - Algorithms Course

SBCACP1151	Lab-2 Data Structures	0L:0T:4P	2 Credits

Note: Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

Lab Programs:

1. Write a program for insertion and deletion operations in an array.
2. Write a program to search for an element in an array using Linear Search and Binary Search.
3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.
4. Write a program to merge two arrays.
5. Write a program to add and subtract two matrices.
6. Write a program to multiply two matrices.
7. Write a program to insert an element into a Singly Linked List:
   (a) At the beginning
   (b) At the end
   (c) At a specified position
8. Write a program to delete an element from a Singly Linked List:
   (a) At the beginning
   (b) At the end
   (c) A specified element
9. Write a program to perform the following operations in a Doubly Linked List:
   (a) Create
   (b) Search for an element
10. Write a program to perform the following operations in a Circular Linked List:
    (a) Create
    (b) Delete an element from the end
11. Write a program to implement stack operations using an array.

12. Write a program to implement stack operations using a linked list.
13. Write a program to add two polynomials using a linked lists.
14. Write a program to evaluate a postfix expression using a stack.
15. Write a program to perform the following using recursion:
    (a) Find the factorial of a number
    (b) Find the GCD of two numbers
    (c) Solve Towers of Hanoi problem
16. Write a program to implement simple queue operations using an array.
17. Write a program to implement circular queue operations using an array.
18. Write a program to implement circular queue operations using a linked list.
19. Write a program to perform the following operations on a binary search tree.
    (a) Preorder Traversal
    (b) Inorder Traversal
    (c) Postorder Traversal
20. Write a program to perform insertion operation in a binary search tree.

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Operating Systems

SBCACT1153	Operating Systems	3L:0T:0P	3 Credits

Course Outcomes (COs):

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

CO1: Explain the fundamentals of the operating system.

CO2: Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management.

CO3: Compare the performance of CPU scheduling algorithms

CO4: Identify the features of I/O and File handling methods.

Course Content:

UNIT I:

Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

UNIT II:

Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads.

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

UNIT III:

Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.

Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

UNIT IV:

Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation. **Virtual Memory:** Demand paging, Page Replacement algorithms, Allocation of frames, thrashing.

I/O Management: Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
4. Dr.S.B.Kishor , Operating System, Dsganu Prakashan , Nagpur.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

SBCACP1152	Lab -3 : Operating Systems	0L:0T:2P	1 Credits

Course Outcomes (COs):

CO1: To implement scheduling of algorithms.

CO2: Understanding the concept of critical section problems.

CO3: Concepts of file allocation of frames.

CO4: Concept of Page replacement algorithms.

Note: Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

Operating Systems LAB

List of experiments

1. Write C program to simulate the FCFS CPU Scheduling algorithm.
2. Write C program to simulate the SJF CPU Scheduling algorithm.
3. Write C program to simulate the Round Robin CPU Scheduling algorithm.
4. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
5. Write a C program to implement the Producer – Consumer problem using semaphores.
6. Write a C program to illustrate the IPC mechanism using Pipes.
7. Write a C program to illustrate the IPC mechanism using FIFOs.
8. Write a C program to simulate Paging memory management technique.
9. Write a C program to simulate Segmentation memory management technique.
10. Write a C program to simulate the Best Fit contiguous memory allocation technique.
11. Write a C program to simulate the First Fit contiguous memory allocation technique.
12. Write a C program to simulate the concept of Dining-Philosophers problem.
13. Write a C program to simulate the MVT algorithm.
14. Write a C program to implement FIFO page replacement technique.
15. Write a C program to write a C program for implementing sequential file allocation method.

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Object Oriented Programming using Java

SBCAST1151	Object Oriented Programming using Java	3L:0T:0P	3 Credits

Course Objectives

CO1: To introduce the object oriented programming system concepts

CO2: To introduce syntax and semantics of Java programming language

CO3: To develop modular programs using Java

CO4: To setup JDK environment to create, debug and run Java programs

Prerequisite: Knowledge of Problem Solving Techniques using C programming language

Course Content:

UNIT I:

Fundamentals of Object Oriented Programming: Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP.

Java Evolution: Java Features, Java Environment.

Overview of Java Language: Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program and JVM, Command Line Arguments.

UNIT II:

Constants, Variables and Data Types: Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Typecasting.

Operators & Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity.

Decision Making, Branching & Looping: Decision Making with Control Statements, looping statements, Jump in loops, Labelled loops.

UNIT III:

Classes, Objects and Methods: Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance

Arrays, Strings and Vectors: 1D arrays, Creating an Array, 2D arrays, Strings, Vectors, Wrapper Classes, Enumerated Types

Inheritance: Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT IV:

Packages: Basics of packages, System packages, Creating and accessing packages, Creating user defined packages, Adding class to a package.

Exception Handling: Using the main keywords of exception handling: try, catch,throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions

Text Books

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

Reference Books

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

Web Resources

1. https://www.w3schools.com/java/.
2. http://www.java2s.com/.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

SBACSP1151	Lab -2 : Object Oriented Programming using Java	0L:0T:4P	2 Credits

Note: Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

List of Practical:

1. Write a program to read two numbers from user and print their product.
2. Write a program to print the square of a number passed through command line arguments.
3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
4. Write a java program to find the largest number out of n natural numbers.
5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non recursive functions.
6. Write a java program to multiply two given matrices.
7. Write a Java program for sorting a given list of names in ascending order.
8. Write a Java program that checks whether a given string is a palindrome or not . Ex:MADAM is a palindrome.
9. Write a java program to read n number of values in an array and display it in reverse order.
10. Create a JAVA class called Student with the following details as variables within it.
    a. USN, NAME, BRANCH, PHONE, PERCENTAGE
    b. Write a JAVA program to create n Student objects and print the USN,Name, Branch, Phone, and percentage of these objects with suitable headings.
11. Write a Java program that displays the number of characters, lines and words in a text.
12. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
13. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.

14. Write a Java program using an interface called ‘Bank’ having function ‘rate_of_interest()’. Implement this interface to create two separate bank classes ‘SBI’ and ‘PNB’ to print different rates of interest. Include additional member variables, constructors also in classes ‘SBI’ and ‘PNB’.
15. Write a Java package program for the class book and then import the data from the package and display the result.
16. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.
17. Write a Java program for demonstrating the divide by zero exception handling.
18. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
19. Create an exception subclass UnderAge, which prints “Under Age” along with the age value when an object of UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the method test() throws UnderAge exception if the variable age passed to it as argument is less than 18. Write main() method also to show working of the program.

Web Technologies

SBCASP1152	**Lab-3 Web Technologies**	**0L:0T:4P**	**2Credits**

Course Objectives : It is a purely Lab oriented course where concerned teacher shall teach the basics of the Web Technologies covering Unit I and II and simultaneously take practicals as listed in part A and part B

CO1: To understand the concepts and architecture of the World Wide Web, Markup languages along with Cascading Style Sheets.

CO2: To understand the concepts of event handling and data validation mechanisms.

CO3: To understand the concepts of embedded dynamic scripting on client and server side Internet Programming and basic full stack web development. CO4: To develop modern interactive web applications

Prerequisite:

1. Proficiency in at least one programming language, such as Python, Java, or C++. Understanding of programming concepts such as loops, conditionals, functions, and data structures like arrays, lists.
2. Familiarity with object-oriented programming (OOP) principles, including classes, objects, inheritance, and polymorphism.

Course Content:

Unit I:

Introduction to HTML, history of HTML, Objective, basic Structures of HTML, Header Tags, body tags, Paragraph Tags.

Tags for FORM Creation, TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME FIELDSET, ANCHOR.

Lists in HTML, Introduction to DIV tag, NAVBAR Design.

Introduction to CSS, types, Selectors, and Responsiveness of a web page.

Introduction to Bootstrap, downloads/linking, using classes of Bootstrap, understanding the Grid System in Bootstrap.

Introduction to www, Protocols and Programs, Applications and development tools, web browsers, DNS, Web hosting Provider, Setting up of Windows/Linux/Unix web servers, Web hosting in cloud, Types of Web Hosting.

Unit II:

Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript.Date and String handling in JavaScript.

Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser.Introduction to AJAX, Purpose, advantages and disadvantages, AJAX based Web applications and alternatives of AJAX.

Introduction to XML: uses, Key concepts, DTD 8 schemas, XSL, XSLT,and XSL Elements and transforming with XSLT. Introduction to XHTML.

JSON: Introduction to JSON, Keys and Values, Types of Values, Arrays, Objects

Text Books

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
2. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017
3. Dr.S.B.Kishor , Web Designing, Dasganu Prakashan, Nagpur.

Reference Books

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Web Resources

3. www.javatpoint.com
4. www.w3schools.com
5. https://www.geeksforgeeks.org/web-technology/

Note: Below Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However the modified list must match with CO-PO mapping

PART-A

1. Create your class time table using table tag.
2. Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags.
3. Create web page using Frame with rows and columns where we will have header frame, left frame, right frame, and status bar frame. On clicking in the left frame, information should be displayed in right frame.
4. Create Your Resume using HTML, use text, link, size, color and lists.
5. Create a Web Page of a super market using (internal CSS) 6. Use Inline CSS to format your resume that you have created.
7. Use External CSS to format your time table created.
8. Use all the CSS (inline, internal and external) to format college web page that you have created.
9. Write a HTML Program to create your college website using for mobile device.

PART – B

1) Write an HTML/JavaScript page to create login page with validations.
2) Develop a Simple calculator for addiction, subtraction, multiplication and division operation using JavaScript.
3) Use Regular Expressions for validations in Login Page using JavaScript.
4) Write a Program to retrieve date from a text file and displaying it using AJAX.
5) Create XML file to store Student Information like Register Number, Name, Mobile Number, DOB, and Email-Id.
6) Create a DTD for (0).
7) Create XML scheme for (0).
8) Create XSL file to convert XML file to XHTML file.
9) Write a JavaScript program using Switch case.
10) Write a JavaScript program using any 5 events.
11) Write a JavaScript program using built in JavaScript objects.
12) Write program for populating values from JSON text.
13) Write a program to transform JSON text to a JavaScript object.

Constitution of India

SBCAVA1151	**Constitution of India**	**2L:0T:0P**	**2 Credits**

Constitution of India as per the SRTMUN common syllabus (VEC course) for all faculties

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Additional Course

SBCAAE1151	Additional Course – Indian or Foreign Language *	**2L:0T:0P**	**0* Credits**

Additional Course – Indian or Foreign Language Other than Mother Tongue and English(1-1-0) [Optional Course] as per the SRTMUN common syllabus for all faculties mentioned as AEC courses in Indian / Foreign languages (Choose any one) . Credit policy is as per the SRTMUN