

DR BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE

Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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PROPOSED CURRICULUM UNDER GRADUATE PROGRAMME

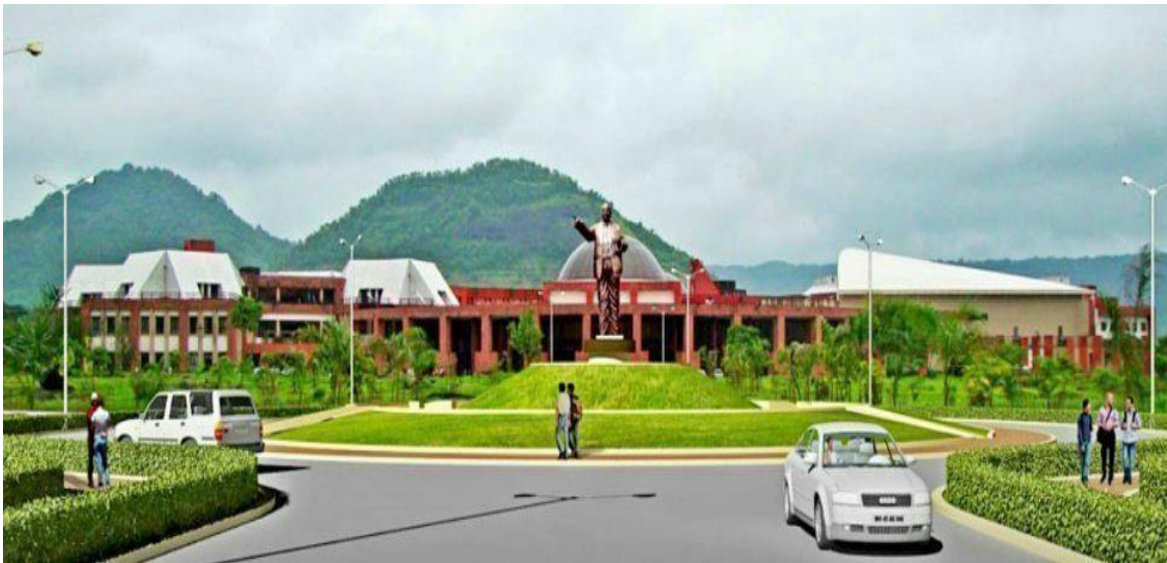
BCA

(BACHELOR OF COMPUTER APPLICATION)

AS PER AICTE's GUIDELINES

WITH EFFECT FROM THE ACADEMIC YEAR 2024-2025

F.Y. BCA 2024-25



SEMESTER I

S.No.	Course Code	Course Title	Weekly Teaching Hours			Evaluation Scheme			Credits	Total Marks
			L	T	P	ISE	MSE	ESE		
1	BCA101T	Mathematics Foundations to Computer Science - I	3	0	0	20	20	60	3	100
2	BCA102T	Problem Solving Techniques	3	0	0	20	20	60	3	100
3	BCA103T	Computer Architecture	3	0	0	20	20	60	3	100
4	BCA104T	General English - I	1	1	0	20	20	60	2	100
5	BCA105T	Indian Knowledge System^ Bucket	2	0	0	20	20	60	2	100
6	BCA106T	Environmental Science and sustainability	2	0	0	20	20	60	2	100
7	BCA107	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (1-1-0) [optional course]*	1	1	0				0*	
TOTAL									15	600
Lab Practicals										
8	BCA102P	Problem Solving Techniques	0	0	4	50	0	50	2	100
9	BCA103P	Computer Architecture	0	0	4	50	0	50	2	100
TOTAL									4	200

Note: ^Indian Knowledge System Bucket: Indian Culture and Civilization Indian Vision for Human Society Indian Science Indian Town Planning and Architecture Indian Mathematics and Astronomy Indian Aesthetics Indian Health, Wellness

*Indian Languages: Sanskrit/Hindi/All Regional languages

Foreign Languages: (not limited to) Spanish/German/French/Korean/Mandarin etc.

SEMESTER II

S.No.	Course Code	Course Title	Weekly Teaching Hours			Evaluation Scheme			Credits	Total Marks
			L	T	P	ISE	MSE	ESE		
1	BCA201T	Mathematics Foundations to Computer Science - II	3	0	0	20	20	60	3	100
2	BCA202T	Data Structures	3	0	0	20	20	60	3	100
3	BCA203T	Operating Systems	3	0	0	20	20	60	3	100
4	BCA204T	Object Oriented Programming using Java	3	0	0	20	20	60	3	100
5	BCA205T	Web Technologies	1	0	0	20	20	60	1	100
6	BCA206T	Indian Constitution	2	0	0	20	20	60	2	100
7	BCA207	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (1-1-0)) [optional course]*	1	1	0				0*	
TOTAL									15	600
Lab Practicals										
8	BCA202P	Data Structures	0	0	4	50	0	50	2	100
9	BCA203P	Operating Systems	0	0	2	50	0	50	1	100
10	BCA204P	Object Oriented Programming using Java	0	0	4	50	0	50	2	100
11	BCA205P	Web Technologies	0	0	2	50	0	50	1	100
TOTAL									6	400

*Indian Languages: Sanskrit/Hindi/All Regional languages

Foreign Languages: (not limited to) Spanish/German/French/Korean/Mandarin etc.

SEMESTER –I

Mathematics Foundation to Computer Science – I

BCA101T	Mathematics Foundation to Computer Science - I	3L:0T:0P	3 Credits
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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, Relation and Function:

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm.

Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions.

Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

UNIT II: Counting and Recurrence Relation:

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem.

Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.

UNIT III: Elementary Graph Theory:

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

UNIT IV: Matrix Algebra:

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, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 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>

Problem Solving Techniques

BCA102T	Problem Solving Techniques	3L:0T:0P	3 Credits
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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), Breaking the Problem into Subproblems, Input/Output Specification, Input Validation, Pre and Post Conditions.

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

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, Definite, Indefinite and Sentinel-Controlled Repetitions. 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, Generating Arithmetic and Geometric Progression, Fibonacci and Other Sequences, Approximate Values For π , $\sin(x)$, $\cos(x)$, Etc. Using Taylor Series. Different Kinds of Data in The Real World and How They are Represented in The Computer Memory. Representation of Integers: Signed Magnitude Form, 1's Complement And 2's Complement. Representation of Real Numbers: IEEE 754 Floating Point Representation. Representation of Characters: ASCII, UNICODE.

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

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

Problems on Numbers: Extracting Digits of a Number (Left to Right and Right to Left), Palindrome, Prime Number, Prime Factors, Amicable Number, Perfect Number, Armstrong Number, Factorial, Converting Number from One Base to Another. Statistics (Maximum, Minimum, Sum and Average) on a Sequence of Numbers which are Read using Sentinel-

Controlled Repetition using only a few Variables.

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: Reading and Writing of Array Elements, Maximum, Minimum, Sum, Average, Median and Mode. Sequential And Binary Search. Any one Sorting Algorithm. Matrix Operations.

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

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.

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.

BCA102P	Problem Solving Techniques	0L:0T:4P	2 Credits
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Problem Solving Techniques: Lab Problems

UNIT-II

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 ($n \geq 0$) 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 ($n > 0$) 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. 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	* * * * *	*

8. Given the first term (a), difference/multiplier (d) and number of terms ($n > 0$), display the first n terms of the arithmetic/geometric progression?
9. Display the first n ($n > 0$) terms of the fibonacci sequence?
10. Display the first n ($n > 0$) terms of the Tribonacci sequence?
11. Given two positive integer numbers n_1 and n_2 check if the numbers are consecutive numbers of the fibonacci sequence?
12. Compute approximate value of π considering first n ($n > 0$) terms of the Taylor series for π ?
13. Compute approximate value of e^x considering first n ($n > 0$) terms of the Taylor series

for e^x ?

14. Compute approximate value of $\sin(x)/\cos(x)$ considering first n ($n > 0$) terms of the Taylor series for $\sin(x)/\cos(x)$?

UNIT-III

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, forthe 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 ($0 \leq \text{marks} \leq 100$) 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) ($2 \leq \text{input Base}$, $\text{outputBase} \leq 10$). 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, $BMI = \text{weightinKGs} / (\text{HeightinMeters} * \text{HeightinMeters})$, 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

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?

Computer Architecture

BCA103T	Computer Architecture	3L:0T:0P	3 Credits
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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, 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, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess- 3 Code, The Gray Code.

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, Reduced Instruction Set Computer(RISC), RISC Vs CISC.

UNIT-IV

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP).
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

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.

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.
4. Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.

BCA103P	Computer Architecture	0L:0T:4P	2 Credits
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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.

General English – I

BCA104T	General English - I	1L:1T:0P	2 Credits
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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: Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Unit-II: Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Unit- III: Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies

Unit- IV: Nature and Style of sensible Writing

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

Unit-V: 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

Unit- VI: 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 Heasley. 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.

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

Indian Knowledge System Bucket

BCA105T	Indian Knowledge System Bucket	2L:0T:0P	2 Credits
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IKS-I: Indian Knowledge Systems and Traditions

Course Objectives

- To sensitize the students about context in which they are embedded i.e. Indian culture and civilisation including its Knowledge System and Tradition.
- To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
- To help to study the enriched scientific Indian heritage.
- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology

Detailed contents:

Module 1: Introduction to IKS

(Any eight of total sessions assigned for Literary activity) Introductory lecture on the **any eight** topics below:

1. Indian Knowledge System
2. Indian Culture & Civilization
3. Ancient Indian Chemistry
4. Ancient Indian Metallurgy
5. Ancient Indian Mathematics
6. Ancient Indian Astronomy
7. Indian Astronomical Instruments
8. Indian Knowledge System (Upveda: Ayurveda)
9. Indian Knowledge System (Upveda: Gandharveda)
10. Indian Knowledge System (Vedangas: Shiksha, Kalpa, Vyakrana)
11. Indian Knowledge System (Vedangas: Jyotisha, Nirukta, Chandas)
12. Indian Architecture I: Sthapatya-Veda
13. Indian Architecture II: Temples
14. Indian Architecture III: Town & Planning
15. Indian Philosophical System

Module 2: Introduction to Creative Practices

(Twenty Lectures with at least Five different topics of total session under Creative activity)

Introductory lecture on the topics below:

1. Dhatuvada: art of metallurgy
2. Akara jnana: art of mineralogy
3. Vastuvidya: art of engineering

4. Yantramatrika: art of mechanics
5. Takshana: art of carpentry
6. Chalitakayoga: art of practicing as a builder of shrines
7. Raupyaratnapariksha: art of testing silver and jewels
8. Maniraga jnana: art of tinging jewels

9. Sucivayakarma: art of needleworks and weaving
10. Vadya vidya: art of playing on musical instruments
11. Geet vidya : art of singing
12. Nritya vidya: art of dancing
13. Natya vidya: art of theatricals
14. Alekhya vidya: art of painting
15. Viseshakacchedya vidya: art of painting the face and body with color
16. Udakavadya: art of playing on music in water
17. Manasi kavyakriya: art of composing verse
18. Bhushanayojana: art of applying or setting ornaments
19. Citrasakapupabhakshyavikarakriya: art of preparing varieties of delicious food
20. Dasanavasanganaraga: art of applying preparations for cleansing the teeth, cloths and painting the body
21. Utsadana: art of healing or cleaning a person with perfumes
22. Vastragopana: art of concealment of cloths
23. Balakakridanaka: art of using children's toys
24. Tandulakusumabalivikara: art of preparing offerings from rice and flowers
25. Pushpastarana: art of making a covering of flowers for a bed

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru
2. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. The Cultural Heritage of India. Vol.I. Kolkata:Ramakrishna Mission Publication, 1972.
4. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
5. Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
6. Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.
7. Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200. London: Routledge.

IKS-II: Indian Culture and Civilization

Course Objectives

- To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa
- To help students to trace, identify and develop the ancient knowledge systems.
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing
- To build in the learners a deep rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Detailed contents:

Module 1: Introduction to IKS

Caturdaśa Vidyāsthānam, 64 Kalas, Shilpa Śāstra, Four Vedas, Vedāᅅga, Indian Philosophical Systems, Vedic Schools of Philosophy (Sāᅅkhya and Yoga, Nyaya and Vaiśeᅅika, Pūrva-Mīmāᅅsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas, Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), Niti Sastras, Subhasitas

Module 2: Foundation concept for Science & Technology

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saᅅkhya System, Kaᅅapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeᅅikan approach to physical reality, constituents of the physical reality, Pramāᅅa, Saᅅśaya

Module 3: Indian Mathematics & Astronomy in IKS

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π , Trigonometry, Algebra, Chandah Sastra of Pingala,

Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.

Module 4: Indian Science & Technology in IKS [Duration: 8 Lectures]

Indian S & T Heritage ,sixty-four art forms and occupational skills (64 Kalas) Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead and Silver), Iron & Steel, Dyes and Painting Technology), Town & Planning Architecture in India, Temple Architecture, Vastu Sastra,

Module 5: Humanities & Social Sciences in IKS [Duration: 8 Lectures]

Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguna System Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kautilyan State

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IKS-III: Indian Vision for Human Society (Vishva Kalyan thru Vasudhaiva Kutumbkam)

Course Objectives

- To help the learner to understand the concept of “vasudhaiva kutumbkam” and its realization process as a base for the development of vision for a humane society.
- To help to identify the universality in humans and its coexistence in existence
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society.
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing of one and all, at the level of individual, society, nation and ultimately the whole world.

Detailed contents:

Module 1: The world view & Vision of Human Society

The concept of non-duality of Prakriti (Jad) and Purush (Chetana), human as coexistence of Jad & Chetan, Pancha-mahabhutas, the root of sorrow and suffering, freedom from sorrow, salvation, eternal peace truth (vyaharika satya), ultimate truth. The acceptance of various systems of philosophy for realization of truth and complementariness in society in ancient Indian system.

Module 2: Aspiration and Purpose of Individual and Human Society

Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha. Individual level; Abhyudaya (progress), Nihisreyasa (perfection) Pravrtti, Nivrtti. Dharma; Dharma sutras (Gautama, apastamba, baudhayana, vasistha). Dharma-Shastra; (manusmriti, naradamrti, visnumrti, yajnavalkya smriti) sociology, different stages of life like studenthood, householdership, retirement and renunciation, rites and duties, judicial matters, and personal laws (Aachara, Vyavahara, Prayaschitta). Artha; Kautliya Arthashastra, Kamandakiya Nitisara, Brihaspati Sutra, Sukra Niti, Moksha: Human liberation (Ignorance to Knowledge)

Module 3: Program for Ensuring Human Purpose: at Individual and Societal level –I

Fundamental concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul). The true constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awareness. The Life Force *Prana* (Praana-Apaana-Vyaana-Udaana- Samaana)

Module 4: Program for Ensuring Human Purpose: at Individual and Societal level - II

Differentiating *Vidya* and *Avidya*, human bondages, Higher and Lower Knowledge (Para Vidhya & Aparā Vidhya). Concept of Sattva, Rajas, Tamas and need of balancing the same, Patanjali yog sutra; Yama, Niyama, Asanas, pranayams, pratyahara, dharna, dhyana, Samadhi, Sixteen category of padartha, pramans (pratyaksh, anumān, upamān, shabda). Saadhana chatustayam (viveka, vairagya, mumukshatavam, shadsampathi (sama, dama, uparama, titiksha, shradha, samadhana), Understanding Nitya karma, Naimittika Karma, Kamya karma, prayaschitta karma, Nishidha Karma.

Meditation and Progressive meditation (Narada's education), Ativadin to self- knowledge, Jyan yog, Karma yog, sanyas yog in aspect to harmonious practice in society

Module 5: Practices for Ensuring Human Purpose – III

Practice in philosophy, architecture, grammar, mathematics, astronomy, metrics, sociology, economy and polity, ethics, geography, logic, military science, weaponry, agriculture, mining, trade and commerce, metallurgy, shipbuilding, medicine, poetics, biology and veterinary science.

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IKS-IV: Indian Science, Engineering and Technology (Past, Present and Future)

Course Objectives

- To familiarize learners with major sequential development in Indian science, engineering and technology.
- To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc.
- To help students to trace, identify and develop the ancient knowledge systems to make meaningful contribution to development of science today
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the scientific, technological and holistic development of physical, mental and spiritual wellbeing.

Detailed contents:

Module 1: Indian Traditional Knowledge; Science and Practices

Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution.

Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant based medicine, Traditional writing Technology

Module 2: Ancient Indian Science (Physics, Chemistry, Maths)

Physics in India: Vaisheshika darshan Atomic theory & law of motion, theory of panchmahabhoota, Brihath Shathaka (divisions of the time, unit of distance), bhaskaracharya (theory of gravity, surya siddhanta & sidhanta shriomani), Lilavati (gurutvakashan Shakti).

Chemistry in India Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhaṭa – building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yaśodhara Bhaṭṭa-process of distillation, apparatus, saranasamskara, saranataila

Mathematics in India: Baudhayana's Sulbasutras, Aryabhata, Bhaskaracharya- I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyēṣṭhadeva

Module 3: Ancient Indian Science (metallurgy, Astronomy, Architecture)

Metallurgy in India: Survarṇa(gold) and its different types, prosperities, Rajata(silver), Tamra(copper), Loha(iron), Vanga(tin), Naga / sisa(lead), Pittala(brass)

Astronomy in India Vedang Jyotish, aryabhata siddhanta, Mahabhaskriya, Laghubhaskariya, vatesvarasiddhanta, Sisyadhivrdhida, Grahashyay, Goladhyaya, Karabakutuhala (Aryabhata, Varahamihira, Brahmagupta, Vaṭesvara, Bhaskara, Paramesvara, NilakanṭhaSomayaji, Jyēṣṭhadeva, ŚankaraVarman)

Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple style, cave architecture, rock cut architecture, kalinga architecture, chandels architecture, rajput architecture, jain architecture, sikh architecture, Maratha architecture Indo- Islamic architectural, Indo-Saracenic revival architecture, Greco Buddhist style.

Module 4: Ancient Indian Science (Textile, Agriculture, Transport)

Textile Technology in India: Cotton (natural cellulose fiber), silk, wool (natural protein fibers), bast and leaf fibers, mridhudhautadhupitambaram (meaning a practice of fumigating the fabric with incense smoke before use as a part of the finishing process), sitadhautavasanyugala (bleached white—a finishing process); suchhastah, sutradharah (needle and thread – tools for stitching). dyeing, washing spinning and weaving technology, Agriculture in India: krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatraka, nadimatraka, use of animals in warfare, animal husbandry, Animals for medicines. Ancient transport in India

Module 5: Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health regimen for wellbeing, introduction to yoga (raja yoga, astang yoga, gyan yoga), understanding of Indian psychological concept, consciousness, tridosha & triguna.

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IKS-V: Indian Town Planning and Architecture

Course Objectives

- To develop the knowledge and analysis on the understanding of eco-friendly, robust and scientific planning and architecture system of ancient India.
- To understand the importance of functional, aesthetic, psychological, culture and socio religious concept of ancient India architecture.
- To help the learners to trace, identify and develop the approach, process and material used in town and planning, construction and architecture
- To review and analyse the importance and significance of visual and performing arts and design in temples, houses, forts, caves and community places.
- To understand the various eco-friendly technology accepted in ancient civilization

Detailed contents:

Module 1: The Introduction to ancient Architecture

Introduction to relationship between Man, Nature, Culture and city forms. Study of determinants (Natural and man-made) influencing location, growth & pattern of human settlements including types of settlements growth (Organic and Planned) and settlement forms.

Architecture as satisfying human needs: functional, aesthetic and psychological outline of components and aspects of architectural form-site, structure, skin, materials, services, use, circulation, expression, character, experience.

Understanding of the causative forces - the cultures, history, socio religious practices and institution, political and economic conditions, issues of land, climate and technology, Historical and Primitive Architecture.

Module 2: Ancient Architecture as Expression of Art & Design

Relationship between Art and Design with man, space and environment. Expression in Art and Architecture – concept of space, sense of enclosure- openness, robustness, dynamism, spatial geometry, Eco-friendliness.

Architecture through use of elements of visual arts such as point, line, plane, form, space, colour, texture, light, solids and voids, shadow and shade etc. Understanding of effect of scale, proportions, order, material effects such as textures, patterns, light, sound, temperature etc in architectural spaces.

Allied visual and performing arts and its relationship to build environments using colour theory, symbolism, glass painting, scriptural writing, clay moulding, stone carving.

Important Indian architecture as per elements space & form **Form:** specific geometry form (sphere, cube, pyramid, cylinder and cone and its sections as well as their derivatives)

Space: build form space, open space, Internal and External space, Continuous spaces Centralized, Linear, Radial Clustered, Grid space Different type of Materials used for construction in Ancient Indian architecture.

Clay products: Classification of bricks, Fire Brick, Fly Ash Bricks, Tiles, Terra- cotta, Earthenware, Porcelain, Stoneware. **Stones:** Uses of Stones, Qualities of Good Building Stones, Dressing, Common Building Stones of India. **Glass:** Different glass Forms and their Suitability, **Timber:** Different Forms and their Suitability **Metals:** Ferrous & Nonferrous Metals and Alloys, and, their Suitability, limitations, precautions **Paints and**

Varnishes: Different types and their Suitability, limitations, precautions

Module 3: Ancient Architecture Principle & Planning

Design: Principles of designing – Composition of Plan. Inception and development of the early Hindu temple form with reference to Vedic and Buddhist planning principles and design elements; Development of regional styles and manifestations thereof; Evolution of temple complexes and temple towns;

Planning: Residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors. Vastu shastra and its importance in building interrelationship with human, nature and cosmos

Town Planning: Town plans of Harappa, Mohenjodaro, Pataliputra, Delhi. Vastu shastra and its application in city layout.

Module 4: Ancient Architecture-I

The settlement planning pattern, elements, associated forms, typical Vedic village, towns (Dandaka, Nandyavarta etc.), typology of Shelters and civic buildings of ancient architecture in reference to following civilization: Indus Valley, Aryan/vedic Civilisation, Buddhist Architecture, Indo Aryan & Dravidian Architecture.

Role of Shilpasasthras and Arthashashtra in settlement planning.

Important architecture: Great baths, Development of fortification, walled towns, structures developed eg: Stupas, Viharas, Chaityas, Stambhas, Toranas, sacred railing etc.

Study of worshipping places with especial reference to Indo Aryan / Nagara style & Dravidian style (Chola, Chalukya, Pallava, Satavahana, Hoysala, Vijayanagara etc.), design of shikharas & gopuram, rock-cut and structural examples of temples.

Module 5: Ancient Architecture-II

Evolution of Hindu Temples in different period: Gupta, Aihole, Badami, Pattadakal, Mahabalipuram, Indo Aryan Style in Orrisa, Khajuraho, Gujarat, Rajasthan. Dravidian Style in Chola, Chalukyan, Pandya, Pallava, Hoysala Style, Revival of Hindu architecture of South India at Vijaynagara and Madurai

Tradition Indian villages & House: Regional house construction, interior & importance e.g. Rajasthani house, bhungas of kutch, nalukettu of kerala, Ikra of assam, manduva logili or illu of Andra Pradesh, wadas of Maharashtra, Mud houses of Madhya Pradesh, kathkuni of himachal Pradesh, khanjaghara of orisa, Taq and dhajji diwari of Kashmir etc.

Scientific achievements though ancient architect: Jantar Mantar, Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79°E 41'54, Veerbhadra temple with 70 hanging pillars, Ellora caves excavating the mountain, Jaipur plan pink city etc.

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IKS-VI: Indian Mathematics and Astronomy

Course Objectives

- To provide information about great mathematicians and astronomers who given significant contribution in Indian mathematics and astronomy.
- To help students to trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge.
- To help to understand the astronomic significance with the human holistic development of physical, mental and spiritual wellbeing
- Enumerate the main characteristics of education system in Vedic and post Vedic period to enrich the intellectual imagination and diminish the dogmatic assurance which closes the mind against speculation

Detailed contents:

Module 1: The Introduction to Ancient Mathematics & Astronomy

Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. aryabhata, bhaskara, brahmagupta, varamahira, budhyana, yajñvalkyya, panini, pingala, bhārat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara)

Periodical enlisting of Mathematical & Astrological achievement in India. Evolution of Indian Numerals (Brahmi (1st century), Gupta (4th century) & Devanagiri Script (11th century)

Module 2: Ancient Mathematics –I

Veda & Sulvasutras (Pythagoras theorem, Square root & Squaring Circle) (baudhayana sulbhasutra, apastamba sulbhasutra, katyayana sulbhasutra, manava sulbhasutra, maitrayana sulbhasutra, varaha sulbhasutra, vadhula sulbhasutra , Pingala's chandasutras, sunya, yaat-tavat, Aryabhata (Aryabhatiya, Asanna, ardha-jya, kuttaka,), bhaskara (trigonometry,shridhara, mahavira), Bhaskara Acharya (Sidhantashiromani), Varamahira panchasiddhantika.

Module 3: Ancient Mathematics –II

Brahmagupta (vargaprakrati, bhramasphuta siddhanta, bhavana), ayatavrta, ganitasarasamgraha, lilavathi, ganesadaivajna, randavantika, suryasiddhanta, grahalaghava, sadratnamala, mandavrta, sigrartta, Bijaganita, Bakshali manuscript Golavada, Madhyamanayanaprakara, Mahajyanayanaprakara (Method of Computing Great Sines), Lagnaprakara, Venvaroha, Sphutacandrapti, Aganita-grahacara , Chandravakyani (Table of Moon-mnemonics)

Module 4: Ancient Astronomy –I

Parahita system of astronomy and drk system of astronomy, Manda samskara, sigrha samskara.

Vedanga Jyotisha (astronomical calculations, calendrical studies, and establishes rules for empirical observation), Aryabhatiya (earth rotation, shining of moon), Brahmasphutasiddhanta (motion of planets), varahmihira (pancasiddhantika), Mahabhaskariya, lahubhaskariya & aryabhatiya bhashya (Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the Moon), Sisyadiveddhida (grahadhyaya, goladhyaya), siddhantasiromani, karanakutuhala (planetary positions, conjunctions, eclipses, cosmography), siddhantasekhara, yantra-kirnavali, Sphutanirṇaya, Uparagakriyakrama.

Module 5: Ancient Astronomy –II

Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and its effects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months, tithis and seasons, time units, sun and moon's motion, planet position, ayanachalana, zero-precision year, katapayaadi system, Indian nakshatra system, astronomy

Instruments for naked eye astronomy (vedic observatories). The principal and application of Samrat Yantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, Dingash Yantra, Utaansh Yantra

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 9. GG Josheph, Indian Mathematics: Engaging with the World from Ancient to Modern Times, speaking Tiger, 2016
 10. BS Yadav, Ancient Indian Leaps into Mathematics, brikausher publication, 2010
 11. DP Chatopadhyaya, Ravinder kumar, Mathematics, Astronomy, and Biology in Indian Tradition: Some Conceptual Preliminaries (Phispc Monograph Series on History of Philosophy, Science and Culture in India, No 3), Munshiram manohalal publication, 1995
 12. BV subbarayappa, The Tradition of Astronomy in India: History of Science, Philosophy and Culture in Indian Civilization Vol. IV, Part 4: Jyotihsastra (History of Science, Philosophy & Culture in Indian Civilization), centre for studies in civilization, 2008
 13. GE Clark, The Aryabhatiya of Aryabhata: An Ancient Indian Work on Mathematics and Astronomy, Kesinger publicaition, 2010
 14. Anonyms, Hindu Astronomy: Anuradha, Bharani, Hindu Chronology, Hindu Calendar, Indian Astronomy, Kerala School of Astronomy and Mathematics, Jyoti, Book LLC, 2011
 15. KV Sharma. Ganita yuktibhasa (Analytical Exposition of the Rationales of Indian Mathematics and Astronomy, Kindle, 2021
 16. R Mercier, Studies on the Transmission of Medieval Mathematical Astronomy (Variorum Collected Studies), routledge publication, 2004

IKS-VII: Indian Aesthetics (including Music and Music Instruments)

Course Objectives

- To provide information about the foundations of Indian aesthetics as integral part of Indian culture
- To help to understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within.
- To help learner to trace, identify and develop the Indian aesthetics to correlate human creative practices
- To build the learners a deep rooted pride in Indian aesthetic knowledge, committed to universal human right, well-being and sustainable development.

Detailed contents:

Module 1: The Introduction to Indian Aesthetics

The nature of aesthetics, principle, its relation to philosophy and literature:

Indian traditions. Sadanga its origin and Applications of Six limbs in Indian Aesthetics
Introduction to Alamkara, Rasa, Dhvani, Vakrokti, Auchitya

Module 2: Ancient Music and Music Instruments-I

Rasa Siddhanta, the concept of Rasa, constituent of rasa (Bhav, abhinay, Sthayibhava, Vibhava, Vyabhicharibhava), number of rasa, Rasasvadana Bharata's Natya Shastra and its Critics, Abhinavagupta's Rasa Siddhanta., Kāvyaaprayojana, Sādhāranikarana, Sahridaya, Rasavighna.

DhvaniSiddhanta, the Concept of Dhvani, Sphota, Pratibhā, classification of dhvani (Laukika Vyangya, Alaukika Vyangya, Avivaksita Vacya, Vivaksitanyapara Vacya) Anandavardana's Dhanyaloka, with reference to Abhidha, lakshana, Vyanjana and Tatpary, extension of dhvani siddhanta to music, dance and drama.

Alamkara Siddhanta, proponent, classification of alamkara, sabdalamkara (Anuprāsa, Yamaka, Ślesha, Dhvanyātmakatā), Arthālamkāra (Upamā, Drstanta, Virodha)

Module 3: Ancient Music and Music Instruments-II

VakroktiSiddhanta, Kuntaka's Vakroktijivita, Classification of Vakrokti (Varna- vinyasa vakrata (Phonetic Obliquity), Pada-purvardha vakrata (Lexical Obliquity) & Pada-parardha vakrata (Grammatical Obliquity), Vakya-vakrata (Sentential obliquity), Prakarana-vakrata (Episodic obliquity), Prabandha-vakrata (Compositional obliquity))

Different Classes of Musical Instrument as per Natyashastra of Bharat, Gana Vadya, Avanaddha Vadya, sushira vadya, tata/tantu vadya.

Brief introduction to following indian instruments

Veena, Ghatam, Gootuvadhyam, Flute, Thavil, Nadaswaram, Mridangam, Plain- drum, Harmonium, Sitar, Sarod, Shehnai, Tabla, Maddalam, violin, morsing, Tambura.

Module 4: Ancient Dance & Drama

Natyaveda: inception from Veda (pathya words(rigveda), abhinaya gestures (Yajureda), geet music (samaveda), rasa emotions (atharvaveda), Natya Shastra, Nata-nritya, geet- nritya, roop-nritya, bhav-nritya

Indian traditional and folk dances (bharatnatyam, kuchipudi, kathakali, yakshagan, Bhangra, Bihu, Ghumura Dance, Sambalpuri, Chhau and Garba

Module 5: Ancient Art

Architecture, sculptures & popular art forms of Pallava& Cholas period, Chalukya & Rastrakuta period, Chandela/Hosalya period, Rajput period. Rock cut architecture, cave architecture, stupa, temples, sculpture

Hindu Shilpa texts as per Vishnudharmotara-puran, Samaranana, Sutrarachana, Sukranitisara, Silparatham

Reference:

1. Histroy of Indian Music by Swami Prajananda, Ram Krishna vedanta math, Kolkata
2. Prof. P. Sambomoorthy: A History of Indian Music, published by the Indian Music

- Publishing House, Madras-1.
3. Hulugur Krishnacharya (Hubli: Introduction to the Study, of Bharatiya Sangita-Sastra, pts. I & II in the Journal of the Music Academy, Madras, vol. I, January, 1930.
 4. Dr. Saratchandra Shridhar Paranjy, Bharatiya Sangit-ki Rupa-Rekha (Hindi) upto the Gupta period, published in the Nada-Rwpa, second issue, College of Music and Fine Arts, Banaras Hindu University, 1963
 5. Prof. G. S. Ghurye: Bharata-Natya and its Costume, published by the Popular Book Depot, Bombay.
 6. Swami Prajnanananda: Historical Development of Indian Music, published by Firma K. L. Mukhopadhyay, Calcutta, 1960.
 7. Swami Prajnanananda : (Bharatiya Sangiter Ltihasaf vols. I & II (Sangita Samskriti] from the primitive period to the 7th century A.D.) In Bengali (published by the Ramakrishna Vedanta Math, Calcutta), Second Edition.
 8. Swami Prajnanananda: Raga O Rupa, vols. I & II (in Bengali) published by the Ramakrishna Vedanta Math, Calcutta.
 9. Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
 10. Shri K. A. Nilakanta Sastri: A History of South India (Second Edition) published by Oxford University Press, 1958.
 11. Kak, S. (2002). *Early Indian music*. In: Buenconsejo, J. (Ed., 2003). *A search in asia for a new theory of music*. P. 59-76. Quezon City: UP Center for Ethnomusicology, University of the Philippines.
 12. Lalita Ramkrishna, Ancient Indian Classical Music, shubhi publications
 13. E Rosenthal, The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past, pilgrims publication, 2007.
 14. Swami parmananda, A History of Indian Music - Volume One: Ancient Period, shri ram Krishna math, 1963
 15. E Celementa Introduction to the Study of Indian Music; An Attempt to Reconcile Modern Hindustani Music with Ancient Musical Theory and to Propound an Accurate and ... of the Subject of Indian Musical Intonation, Franklin Classical trade press, 2018
 16. SC Benerjee Fundamentals of Ancient Indian Music and Dance, Asian Book Corporation, 1976
 17. Samita Redday, Ancient Indian Music, cyber Tech Publications, 2018.

IKS-VIII: Indian Health, Wellness and Psychology (including Ayurved)

Course Objectives

- Understanding the fundamental principles of Indian health systems such as Ayurveda and yoga which are useful in maintaining the health of a healthy person
- Practical implementation of health principles to correct the intake of our food, air, water and sunlight to achieve perfect health.
- Understanding traditional way of cleansing the body regularly, strengthening body with Yogic exercises, maintaining the internal balance to prevent diseases.
- Understanding our unique Mind Body Constitution and choosing the right lifestyle suitable to maintain the internal balance.
- Understanding the influence of external environment on internal health and ways to synchronise our body and mind with nature to ensure smooth functioning of all organ systems of our body.
- Understanding mind and its dynamics through knowledge of Ayurveda and Yoga and using the knowledge to maintain harmony between body and mind to achieve perfect mental health.

Detailed contents:

Module 1: Understanding human body [Duration: 8 Lectures]

Introduction to Ayurveda, the Knowledge of Life, Health and treatment aspects in Ayurveda, Influence of Pancha maha bhuta on Internal environment of Human being, Understanding composition of Human body through the concept of Dosha Dhatu Mala, Understanding Prakruthi , the Mind – Body Constitution.

Module 2: Understanding the communication between body & Mind

Establishing communication between body and mind by understanding the language of body. Understanding the concept of Agni, Koshta, Sara and Ojas and their relevance in enhancing our immunity to protect from various infections. Looking at the world through the lenses of Dravya, Guna and Karma Applying the principle of Samanya and Vishesha in every aspect of life to achieve perfect health.

Module 3: Introduction to Health Regimen

Understanding Swastha vritta, the healthy regimen to maintain state of wellbeing Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene. Ritu charya, the seasonal regimen, Sadvritta and the concept of social wellbeing, understanding trividha upastambhas, three pillars to health, Concept of Shadrassa in choosing appropriate nourishment to the body and mind.

Module 4: Introduction to Yoga

Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhakti yoga Understanding eight steps of Ashtanga yoga, Understanding Shatkriyas , the six cleansing procedures of Yoga

Module 5: Introduction to Indian Psychology

Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna based Psychology in Ayurveda and Yoga, Influence of Tri dosha on Mind, Mind body intellect and consciousness complex, Understanding Consciousness and solution to issues within Human Mind.

Reference:

- 1.The Charaka Samhita
- 2.The Susruta Samhita
- 3.Teh Ashtanga Hridaya
- 4.Dr Deepak Chopra, Perfect Health--Revised and Updated: The Complete Mind Body Guide, Harmony publication, 2001
- 5.Vasant lad, Ayurveda, the Science of Self-healing: A Practical Guide: Science of Self-healing, lotus press, 1984
- 6.The Hatha yoga pradipika
- 7.The Patanjali yoga sutras
- 8.The Gheranda samhita
- 9.BKS Iyengar, Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority, thronson publication, 2006
10. Swamy Satyananda Saraswati, Asana, Pranayama, Mudra and Bandha, Bihar School of Yoga, 2002

Environmental Science and Sustainability

BCA106T	Environmental Science and Sustainability	2L:0T:0P	2 Credits
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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 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. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.

Unit 3: Environmental Pollution, 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; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.

Unit 4: Social Issues, Legislation, and Practical Applications

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. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

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/klings/ecosystem/ecosystem.html>

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.

SEMESTER – II

Mathematics Foundation to Computer Science – II

BCA201T	Mathematics Foundation to Computer Science - II	3L:0T:0P	3 Credits
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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:

Logic and Methods of Proofs:

Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).

Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

UNIT II:

Algebraic Structures:

Semi-group, Monoid, Group, Subgroup, Cyclic group.

UNIT III:

Numerical Methods:

Concept and importance of errors in 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 and Lagrange's formula.

Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule

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, Duality.

Transportation problem: Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

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, Macmillan Publishers, 2007.

Web Resources

1. <https://nptel.ac.in/courses/111107127>
2. <https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf>

Data Structures

BCA202T	Data Structures	3L:0T:0P	3 Credits
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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, Matrices and Sparse Matrices, 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: Addition of Polynomials.

Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining.

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, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.

Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority 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, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL 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](#)

BCA202P	Data Structures	0L:0T:4P	2 Credits
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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.

Operating Systems

BCA203T	Operating Systems	3L:0T:0P	3 Credits
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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.

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.

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.

BCA203P	Operating Systems	0L:0T:2P	1 Credits
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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.

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.

Object Oriented Programming using Java

BCA204T	Object Oriented Programming using Java	3L:0T:0P	3 Credits
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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, Difference between Java, C and C++, Java and Internet, 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.

Text Book 1: Chapters 1, 2 and 3.

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.

Text Book 1: Chapters 4, 5, 6, and 7.

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.

Text Book 1: Chapters 8, 9, and 10.

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 Book 1: Chapters 11 & 13.

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

BCA204P	Object Oriented Programming using Java	0L:0T:4P	2 Credits
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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 commandline 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. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the superclass. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. 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.
12. Write a Java program that displays the number of characters, lines and words in a text.
 13. 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.
 14. 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.
 15. 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'.
 16. Write a Java package program for the class book and then import the data from the package and display the result.
 17. 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.
 18. Write a Java program for demonstrating the divide by zero exception handling.
 19. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
 20. 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

BCA205T	Web Technologies	1L:0T:0P	1 Credit
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Course Objectives

- 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

Reference Books

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

Web Resources

1. www.javatpoint.com
2. www.w3schools.com
3. <https://www.geeksforgeeks.org/web-technology/>

BCA205P	Web Technologies	0L:0T:2P	1 Credit
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Practical list of Programs:

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 addition, 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.

Indian Constitution

BCA206T	Indian Constitution	2L:0T:0P	2 Credits
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Course Content:

Unit 1: The Constitution - Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2: Union Government

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3: State Government

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4: Local Administration

- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5: Election Commission

- a. Role and Functioning
- b. Chief Election Commissioner
- c. State Election Commission

Suggested Learning Resources:

1. Ethics and Politics of the Indian Constitution by Rajeev Bhargava, Oxford University Press, New Delhi, 2008
2. The Constitution of India by B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India by DD Basu Lexis Nexis; Twenty-Third, 2018 edition

Suggested Software/Learning Websites:

- a. <https://www.constitution.org/cons/india/const.html>
- b. <http://www.legislative.gov.in/constitution-of-india>
- c. <https://www.sci.gov.in/constitution>
- d. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

Cases

- Rustom Cavasjee Cooper v. Union of India, (1970) 1 SCC 248
- State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068 (confirmation of a private monopoly, not a violation of fundamental right)
- Mithilesh Garg v. Union of India, (1992) 1 SCC 168 : AIR 1992 SC 221 (Right to carry on business, not breached when it is liberalised)
- Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118 (scope of reasonable restrictions in relation to trade and occupation)
- Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220 (the reasonableness of the restriction imposed may depend upon the nature of the business and prevailing conditions including public health and morality)
- T. B. Ibrahim v. Regional Transport Authority. Tanjore, AIR 1953 SC 79
- Harman Singh v. RTA, Calcutta, AIR 1954 SC 190
- Dwarka Prasad Laxmi Narain v. State of U.P., AIR 1954 SC 224
- State of Bombay v. R.M.D. Chamarbaugwala, AIR 1957 SC 699
- Parbhani Transport Coop. Society Ltd. v. Regional Transport Authority, Aurangabad, AIR 1960 SC 801
- State of Bombay v. R. M. D. Chamarbaugwala, (1957) S.C.R. 874,
- G.K.Krishnan vs State of Tamil Nadu, 1975 SCC (1) 375
- Automobile Transport (Rajasthan) Ltd. Vs State of Rajasthan, AIR 1962 SC 1406

Course Outcome(s):

Upon completion of this course, students will be able to:

1. Constitutional Framework: Analyze the Indian Constitution's history, Preamble, Fundamental Rights, and basic structure.
2. Union Government Structure: Describe the roles of the President, Prime Minister, and the legislative bodies (Lok Sabha and Rajya Sabha).
3. State Government Mechanisms: Examine the powers of the Governor, Chief Minister, and the State Secretariat.
4. Local Administration: Assess the functioning of local government bodies like District Administration, Municipal Corporations, and Zila Panchayats.
5. Electoral Processes: Analyze the role of the Election Commission in conducting free and fair elections.
6. Application of Knowledge: Apply constitutional principles to contemporary political issues and evaluate governance effectiveness.
